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NOVEMBER

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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President's Address—*Oliver*
Cementoma—*Dewey*
Abutment Preparations—*Smith*
Dental Education—*Robinson*
Periodontia—*Spalding*
Tooth Color—*Clark*
Insurance, State and Panel Systems—*Simons*
Medical Insurance in United States—*Sinai*
Lactobacillus Acidophilus—*Rodriguez*
Evolution of Dental Practice—*Brown*
Successful Dental Practice—*Johnson*
Class Three Malocclusion—*Hellman*
Growth Velocity and Quality of Enamel—*Swanson*
Slotted Tray—*Gentilly*
Changes in Maturation of Teeth—*Beust*
EDITORIALS
Eighth Congress—Double Problem
COUNCIL ON DENTAL THERAPEUTICS
Annual Report
DENTAL HEALTH EDUCATION
Care of Hospital Staff—*Erdreich*
Bonn Method—*Neumann*

CONTENTS

Jules John Sarrazin, D.D.S. (1865-1931) ..... Frontispiece

ORIGINAL COMMUNICATIONS

President's Address.
By Robert Todd Oliver, D.D.S. 2049

Case of Genuine Cementoma.
By Kaethe W. Dewey, M.D. 2052

Abutment Preparations.
By Donald E. Smith, D.D.S. 2063

Influence of Dental Education on Professional Progress and Attainments.
By J. Ben Robinson, D.D.S., F.A.C.D. 2075

Conservation Applied to Periodontia.
By Grace Rogers Spalding, D.D.S., F.A.A.P. 2087

An Analysis of Tooth Color.
By E. Bruce Clark, D.D.S. 2093

Insurance, State and Panel Systems for Medical and Dental Care as Now in Existence.
By A. M. Simons 2104

The Medical Insurance Situation in the United States.
By Nathan Sinai, D.P.H. 2113

Quantitative Incidence of Lactobacillus Acidophilus in the Oral Cavity as a Presumptive Index of Susceptibility to Dental Caries.
By F. E. Rodriguez, B.Sc., D.D.S. 2118

Some of the Contributing Factors in the Evolution of Dental Practice.
By Homer C. Brown, D.D.S., F.A.C.D. 2135

Building and Maintaining a Successful Dental Practice.
By C. N. Johnson, L.D.S., D.D.S. 2143

Morphology of the Face, Jaws and Dentition in Class Three Malocclusion of the Teeth.
By Milo Hellman 2150

The Relation of Growth Velocity to the Quality of the Enamel.
By John H. Swanson, M.S. 2174

Technic for the Use of Slotted Tray for Sectional Plaster Impressions.
By J. V. Gentilly, D.D.S. 2177

Posteruptive Changes in the Maturation of Teeth.
By Theodore B. Beust, D.D.S. 2186

Roentgenographic Examination of Dental Gold Alloys.
By John S. Spell, B.S., and Donald McCormack 2193

What Science Does Not Explain.
By J. E. Schaefer, M.D., D.D.S. 2195

Traumatic Occlusion the Etiologic Factor in Pyorrhea.
By R. Morse Withycombe 2201

EDITORIAL DEPARTMENT

The Eighth International Dental Congress. — The Possible Solution of a Double Problem. — The Art of Thinking. — Jules John Sarrazin, D.D.S. (1865-1931). — Frank T. Breene, D.D.S., M.D. — Dental Relief 2205-2211

COUNCIL ON DENTAL THERAPEUTICS

Annual Report of the Council on Dental Therapeutics 2212

BUREAU OF DENTAL HEALTH EDUCATION

The Care of the Hospital Staff.
By Joseph Erdreich, D.M.D. 2223

The Bonn Method for the Dental Care of School Children.
By Friedrich Neumann, M.D. 2225

Teeth as They Affect Personality.
By William H. Gilpatric, D.D.S. 2229

Dentistry as a Health Service.
By Frank Delabarre, A.B., M.D., D.D.S. 2232

The Building and Upkeep of the Dental Machine.
By E. Melville Quinby, D.D.S. 2235

Diet.
By Raeburn R. Davenport, D.D.S. 2239

CURRENT LITERATURE

Extracts and Abstracts 2241

MISCELLANY

Book Reviews 2244
News 2247

Announcements 2248

ADVERTISEMENTS

Index to Advertisements A-49
Classified Section A-43, A-44

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(1865-1931)

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Original Communications

PRESIDENT'S ADDRESS*

By ROBERT TODD OLIVER, D.D.S., Philadelphia, Pa.

IN reviewing the history of American dentistry during the last one hundred and fifty years, one is impressed by the remarkable advancement and outstanding achievements of the young profession, so recently released from its chrysalis. Its rapid development has been incident to, and largely the result of, the occurrences of three great epochs that have marked its career and established eras of beneficial progress.

The first epoch to be proclaimed is the advent of modern dentistry in our country. This occurred during the last year and a half of the American Revolution, at Newport, Rhode Island (1780-1781). It came as an automatic contribution of two French medical officers who accompanied the troops loaned to the struggling colonies by King Louis XVI. Naturally, they brought the doctrines of their celebrated countryman, Pierre Fauchard, later known as the Father of Modern Dentistry. These two compatriots, LeMaire and Gardette, conducted what nowadays would be termed a camp clinic at the allies winter camp near Providence, where relief for dental ills was offered the officers and men of both armies. Their skilled operations attracted the attention of groups of colonial soldiers, many of whom evinced a decided interest in the new ministrative vocation, and voiced a desire to learn it.

In compliance with such requests, a small coterie of young American soldiers were chosen to act as assistants and to receive instruction. It is noteworthy to observe that, after the war, several of these novices took up the new vocation of dentistry, and not only conducted it satisfactorily as a career, but, in turn, became teachers of its doctrines, thus spreading a knowledge of dentistry to

*Read before the First General Meeting of the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 20, 1931.

students throughout the land, for the ultimate benefit of its people.

During the next forty years, many young men of the growing republic entered on the practice of dentistry, and those of an adventurous spirit followed the trend of the times in the westward migration, until dentists could be found in many of the towns in the opening Middle Western states. During the later years of this period, it became noticeable that men of superior educational attainments were attracted to dentistry. Often, medical practitioners, becoming aware of its value, absorbed it either wholly or in part as a branch of their professional ministrations. This class of men and those connected with medical schools eventually became the leaders of dentistry, proponents of the dental society organization and of dental educational projects.

In 1839 occurred the famous decision of the Medical Faculty of the University of Maryland in declining to establish a dental department in the university, stating that as dentistry was of little consequence, and the university was overtaxed, such action could not be taken. The reaction to this stinging decision marked the beginning of second great epoch of American dentistry, one which brought the determination to organize an independent dental school, which founded the Baltimore College of Dental Surgery in 1840, created dentistry as a real profession and provided it with a degree (D.D.S.). It provided, also, for the perpetuity of dentistry by the establishment of a sound educational program, and established provisions for complete autonomy of the profession. From this epoch sprung an era of joyous self esteem and confidence in the hearts of the rank and file of dentistry, who began to build toward an ideal. The organization of dental societies, local, state and national, took place without undue delay. Dental journals began to appear, and the desire for expansion of dental education became manifest, within the next few years, by the opening of dental colleges in several sections of the country. Laws were enacted within the several states regulating the practice of dentistry, and state examining boards were established to determine the qualifications of applicants seeking to practice therein. Happy growth, prosperity and satisfactory professional standing, among the laity, had now arrived for dentistry in all its activities.

Feb. 2, 1901, marked the third great epoch of American dentistry, the enactment by Congress of a law creating the Army Dental Corps, to be attached to the Medical Corps of the Army. In securing this legislation, the fine men making up the Legislative Committee of the National Dental Association "builded far better than they knew," for not only was a much needed dental service supplied for officers and men of our Army then operating in the Antipodes, ten thousand miles from home, but automatically it brought to dentistry that priceless boon, governmental recognition of its value as a health-conserving service for its great military establishment. Thus, there followed an era of unparalleled success and happy satisfaction. It seemed that the highest goal had been attained. Government recognition brought greater appreciation from the medical profession, enhancing the value of dentistry as a health-serving profession, and as an ally in solving many of the complex problems of the care of the sick.

Dentistry itself was stimulated to greater exertion. Many important new specialties of the profession sprang into

existence; dental education took on whole-heartedly the inclusion of courses in science, established research sections and entered on the teaching of dental participation in the treatment of systemic disease. Both practitioners and students were led outside the old, narrow, crippling scope wherein the average dentist's vision was bounded merely by the diameter and circumference of the mouth's largest molar, and where the possibilities of pathologic oral tissue conditions or of systemic complications were disregarded.

Dental societies, accepting the trend of events, prepared their programs accordingly. It was readily noticeable that essays, papers, addresses and discussions were teeming with scientific articles, and that the question of oral focal infection in relation to systemic disease had permeated the dental atmosphere, indicating that dentistry's acceptance of the health-serving idea had been complete and sincere.

As an indication that the new appellation, dentistry, a health service, had permeated the public official mind, state, municipal and educational, one observes with satisfaction the inclusion of dental members on boards of health, state, county and city, on the professional staffs of hospitals, boards of education, child health and welfare committees and in other groups. Medical divisions of nearly all the large life insurance companies installed a dental section under a dental director, to function consistently in conserving the health of its vast army of policyholders. Many of the larger industrial organizations throughout the country, employing hundreds, even thousands, of operatives, established dental clinics in their plants for the immediate relief of dental suffering, and for dental care and attention when required. Several of our great philanthropists created foundations and endowments for the establishment and maintenance of children's dental clinics, with the view of assuring the dental health of each child as an important adjunct to his general health. School clinics, municipal clinics and charity clinics, operated and maintained by groups of broad-minded dentists, have sprung up in cities and towns throughout the country, until it may be said that a fair degree of dental mindedness has begun to develop in a majority of our citizens, and that American school children actually have become "tooth conscious," alert to the value of clean and wholesome mouths and teeth.

Dentistry's response to "the call to arms" was nothing short of magnificent. More than 5,000 of her fine young men joined the colors, willing and ready to do their part in maintaining the health and physical fitness of America's fighting men. Some 2,000 of them, who served overseas, helped gloriously to stamp indelibly the name of American dentistry upon the war torn maps of Europe, while the remaining 3,000 "carried on" in the training camps and hospitals of the homeland, held in reserve for further calls from the front and eager for the arduous overseas duty. Their glorious patriotism remains undimmed, and their evidence of courageous desire is just as high. "They also serve who only stand and wait."

Without entering into detail, I may say with pride that the character and amount of dental, oral surgical and oftentimes plastic surgical service rendered by your own professional brethern in the field and in the hospitals of France served to retain the world-wide reputation of supremacy for American Dentistry.

The splendid services rendered by the Preparedness League of American Dentists in extending early dental health service to the drafted men of our field Armies must not be overlooked. This magnificent patriotic body of dentists, composed of 6,000 members, mostly of men over the military age or otherwise prevented from serving with the colors, rendered valiant service to our soldiers prior to their assembly at camp, in an endeavor to make every man "dentally fit" before he left for the front. This organization has the wonderful record of having accomplished 375,000 operations before the close of hostilities, and even more commendable is the glory of having contributed this stupendous service to their brothers-in-arms, freely and without cost. A splendid type of loyal patriotism.

Just what, where and when the next great epoch of American dentistry may open is within the bosom of the future, too problematic even for conjecture.

In whatever manner it may present, whether along lines of reorganization in the scope, character and methods of conducting a dental practice, in educational revolution, in mutual agreement for its return to and mergence with medicine, or whatnot, let us fervently hope that the sacred heritages handed down to us from the fathers, our profession's proud name, its degree, its autonomy and the control of its educational program, shall remain inviolate; that the splendid record of American dentistry shall proceed onward and upward, unimpaired in following the dictates of its manifest destiny to its glorious seat in the sun—a benefactor to mankind.

CASE OF GENUINE CEMENTOMA*

By KAETHE W. DEWEY, M.D., Pittsburgh, Pa.

CEMENTOMAS are common in horses and cattle, but rare in man. Most of the reported cases are pseudocementomas, i.e., areas of hyperplastic cementum laid down about other dental structures, such as enamel and dentin, or supernumerary and retained teeth. Genuine cementomas, composed entirely of cementum, are observed chiefly by veterinaries (Joest[1]). They are very rare in man. The tumor to be discussed here, which is of this type, presents features that make it particularly interesting from the histogenetic standpoint.

The growth was found in a woman, aged 40, who complained of pain about the ear and soreness in the floor of the mouth. An ear and nose specialist who examined her found nothing to explain the symptoms and advised her to have full upper and lower roentgenograms made. After a general physical examination by a physician, she was referred to the dentist, with the advice that her four lower incisors be extracted. These teeth were tested and found to be vital. The roentgenogram revealed a small

*From the Research Department of the School of Dentistry, University of Pittsburgh.

1. Joest, E.: Spezielle Pathologische Anatomie der Haustiere, 1919.

granuloma at the apex of the right lateral incisor and a mass about the apex of the left central incisor which the roentgenologist diagnosed as a calcified granuloma, or possibly a calcified dental follicle. There was some slight exostosis at the root of the tooth. The four teeth were extracted and, three weeks later, the small hard tumor was removed. A roentgenogram made two months afterwards showed that reorganization and bony replacement had taken place along the bottom of the vacant space. The pain about the ear had subsided, while short, twitching pains had been felt in the mouth now and then for some time. (Fig. 1.)

Fig. 1.—Cementoma at apex of left lower central incisor.

Histologic examination of the hard mass at the apex of the left central incisor showed that it was not a calcified granuloma. There is no morphologic evidence whatever of a granuloma in this tissue, neither of the inflammatory nor of the healing stage. Nor have the calcified structures in this tumor anything whatever in common with those not infrequently observed in a granuloma. As to total calcification of a granuloma, I am not aware of a record of such an occurrence. The calcified bodies which may be seen in a granuloma denote areas of tissue degeneration and tissue necrosis, with subsequent impregnation of calcium salts. In contrast to this, the calcified organized structures in the periapical tumor here described are made up of newly formed tissue, namely cementum. The connective tissue, or stroma, which produces this cementum is singularly free from any element denoting inflammation or infection.

As to calcification of the dental follicle, this process is commonly assumed to take place in the form of a cementoma. In Bland-Sutton's[2] classification of odontomas, the one most generally accepted, the cementoma is one of the four types of tumors derived from the tooth follicle. According to his statement, the tissue of this structure which is denser and more vascular than the rest of the connective tissue surrounding the developing tooth sometimes increases greatly in thickness and becomes what Bland-Sutton calls a "fibrous odontoma." When the thickened capsule displays the tendency to form cementum and to become calcified, a cementoma develops.

In cases of pseudocementomas, i.e., areas of hyperplastic cementum about retained supernumerary and rudimentary teeth, or remnants of teeth, and also in cases of congenital genuine cementomas, the dental follicle may logically be considered as the structure undergoing calcification. The cementoma which will be described in the following does not belong to any of these categories. It does not contain any dental structures other

2. Bland-Sutton, J.: Tumours Innocent and Malignant, Ed. 4, London: 1923.

than cementum, and there is no argument whatever for the belief that it might be a congenital growth. This tumor, found in a patient, aged 40, is small and there is no reason to believe that it had been of long standing. All along the periphery on one side, processes of active growth are in evidence abundantly, and also the tissue of the central part in various regions shows recent formative activities rather than quiescent stages, and the regressive changes that tissue has as great potential and actual ability for cement formation as the dental follicle.

The cementogenous ability or tendency of the periodontal membrane which is constantly displayed in the various forms of apposition and repair of the root cementum is also manifest in the frequent development of cementicles. These may occur in any part of the periodontum and at any age, although there are sites of predilection, such as the bifurcation of

Fig. 2.—Epithelial cementicles in medullary spaces of alveolar bone near root end of tooth. *a*, tooth; *b*, periodontal membrane; *c*, alveolar bone; *d*, cementicles, one showing cluster of calcified epithelial cells in center; *e*, epithelial cells in state of calcification. The location of the cementicles in spaces surrounded by bone and the presence of bundle bone indicate that there had been traction on this side of the tooth and that the periodontal membrane formerly occupied the place in which the cementicles are seen.

are present are only slight. It is illogical to assume that, in such a case, the dental follicle played any part in the genesis of the growth. This sac had ceased long ago to exist as such. It had long ago been replaced by the periodontal membrane, and, as to its function, the periodontal roots, and, in some persons, the tendency to cementicle formation is very pronounced. (Fig. 2.) Since the cementoma in our case represents a conglomeration or fusion of cementicles, these structures may be briefly discussed before the tumor is described.

A typical cementicle has a so-called nucleus around which cementum is laid down in concentric layers. The nucleus consists of a single cell or groups of cells which undergo calcification. It is commonly believed that the majority of cementicles are epithelial cementicles, i.e., cementicles having epithelial cells for a nucleus. Some cementicles consist solely of calcified epithelial cells. As to the origin of these epithelial cells in the periodontal membrane, Malassez's paradental epithelial remnants are quite generally considered as the source. Besides epithelial cells, connective tissue elements of the periodontium may furnish the nucleus for cementicles, as well as thrombi and vessels.

Various opinions have been expressed with reference to the process which leads to calcification of the cells and subsequent cement formation. There are those who hold the view that the epithelial cells which calcify undergo these changes because of a disturbance of their colloid state; in other words, because they have

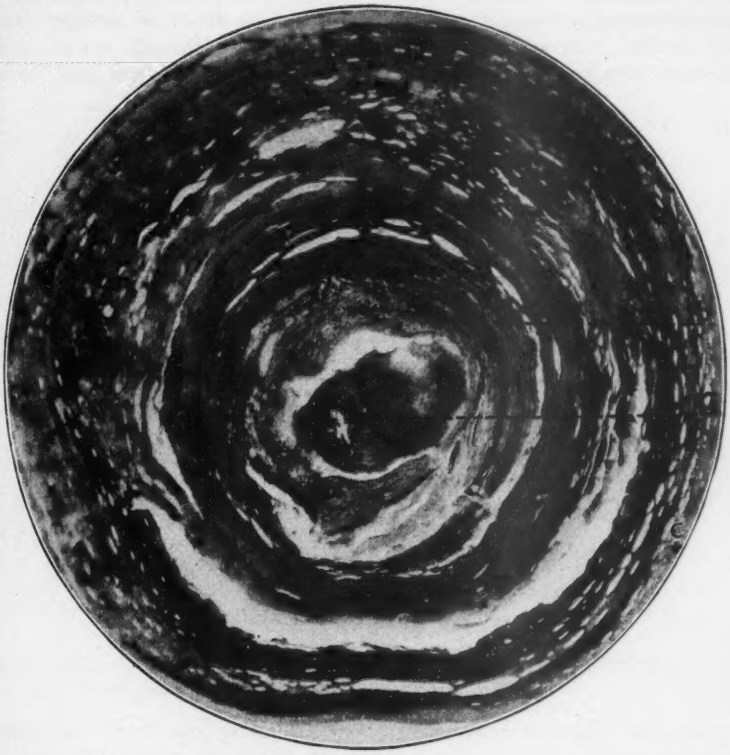

Fig. 3.—Large cementicle. *a*, nucleus composed of nonorganized material; *b*, regular layers of primary cementum; *c*, uncalcified precementum.

become dystrophic. Gottlieb[3] is of the opinion that the particular cells of the epithelial cell-unit which become the center of a cementicle have a greater vitality and are capable of activating the periodontal tissue, stimulating it to the formation and deposition of cementum. Such cells, when losing their connection with the epithelial cell nests, become larger and stain more intensely. According to Gottlieb, they seem to cause injury to the alveolar bone and the peri-

Euler and Meyer,[5] on the other hand, believe that the calcification of the epithelial cells is initiated by metabolic disturbances of the periodontal tissue. Under the influence of such disturbances, the epithelial cells lose their ability to hold the calcium salts in solution and calcify, retaining their outer form more or less. Also catabolic products may calcify and constitute the nucleus. According to Bauer, the cells which undergo calcification are cells disrupted from the

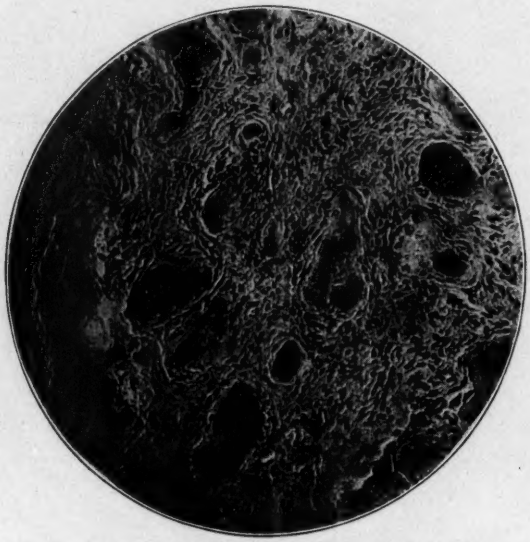

Fig. 4.—Small cementicles surrounded by layer of cementoblasts lying parallel to surface of bodies.

odontium; but when they become encapsulated by cementum, they are made harmless again (quoted from Bauer[4]).

disintegrating units of cells, the epithelial cords or cell nests, and calcification takes place as a result of dystrophic and degenerative changes.

Spring[6] has called special attention to

3. Gottlieb, Bernhard: Zementexostosen, Schmelztropfen und Epithelnester, Ztschr. f. Stomatol., 1921, No. 9, quoted by Bauer.

4. Bauer, W.: Ueber Zementikel und zementikelähnilche Einlagerungen in der Wurzelhaut, Vierteljsschr. f. Zahnheilk., 45: 345, 1929.

5. Euler, H., & Meyer, Wilhelm: Pathohistologie der Zähne (Zementikel, p. 251), Munich, 1927.

6. Spring, K.: Beitrag zur Kenntnis der Exzementosen, Ztschr. f. Stomatol., 28:972, 1930.

the fact that epithelial cementicles are always composed of primary or fibrillar cementum, while cementicles which develop about old areas of hemorrhage, bone fragments or dentin splinters within the periodontal membrane are always made up of secondary or bone cementum. The assumption that primary cementum is formed only in epithelial cementicles has been so general that it has almost come to be accepted as a fact, and attempts have been made to discover or state the reason for this occurrence. A specific action of the calcified epithelial cells of such cementicles on the surrounding periodontal tissue has been assumed. This supposition can, according to a statement by Spring, be refuted only if it can be convincingly shown that primary cementum may also be formed about calcified foci of a genesis other than epithelial cells. The report of such an occurrence is found in a recent publication by Rywkind, and the cementoma which I am reporting here is an illustration of processes of this kind. In both instances, the cementicles were composed of primary cementum and had connective tissue cells for nuclei. Epithelial cells were conspicuously absent in the surrounding connective tissue in either case. Rywkind[7] observed large numbers of cementicles of this type in a simple epulis in which bony spicules also were present. In his case, the cementicles were single and scattered in the tissue. In my case, single cementicles are present only in the youngest portion, i.e., in a peripheral zone, where the processes of proliferation are the most recent. As the cementicles enlarge, they

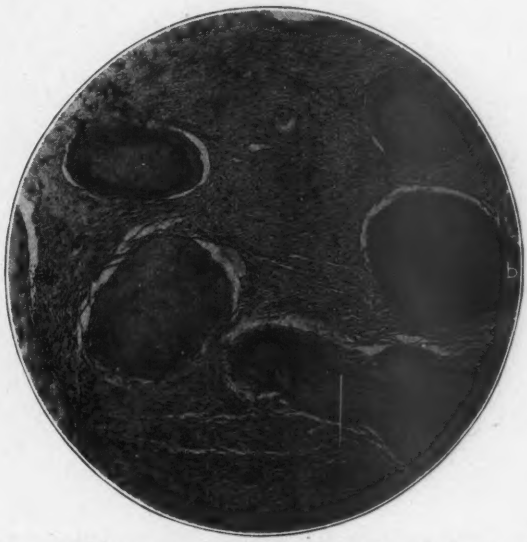

Fig. 5.—Larger cementicles, most of them showing concentric layers of cementum. *a*, cementicle including small cementicle, *b*.

7. Rywkind, A. W.: Zur Frage der Zementikelbildung, Ztschr. f. Stomatol., 28:1178, 1930.

join neighboring growing cementicles, and the fully developed tumor is nothing but a conglomeration of cementicles.

Most of the so-called free cementicles in the periodontal membrane are microscopic. Recently, I have had occasion to observe two cementicles of macroscopic size. Each was as large as a large-sized pinhead. They were found in a man, aged 49, in the periodontium near the root ends of the second molar, one on the distal, the other on the mesial side. nucleus composed of nonorganized calcified material. (Fig. 3.) Around this large solid mass in the center, there are a large number of concentric layers of cementum. The latter has the characteristics of irregular primary cementum, which is not infrequently seen about tooth roots and which indicates disturbances in root-cementum formation at certain periods of development. The irregularities are seen in the width of the layers, the structure itself and the degree

Fig. 6.—Shell-like cementicles lying close together and welded into a solid mass by cementogenous activity of intervening connective tissue (*ct*).

There had been a fistula distally to this molar tooth. A thin band of fibrous tissue had apparently been connected with the cementicle on that side, but was severed from it in the removal of the small body. The two structures, round bodies with a smooth surface, were so loosely attached that they came out almost as separate bodies. A cross-section of the one on the distal side shows a large of calcification. Numerous oval spaces are seen in the interlamellar zones. They represent cementoblasts which were encapsulated as new layers of cementum were laid down. Most of the spaces are empty. Numerous slits and fissures indicate the brittleness of the tissue, especially at the junction of lamellae. These peal off, so to speak. The layer nearest the periphery consists of precementum or

noncalcified cementoid tissue. It is homogeneous and stains pink with eosin. Whether the fibrous band that appeared attached to this solitary cementicle represented the remains of the fistula can only be surmised. The microscopic appearance of the central mass of the cementicle would lead one to assume that products of disintegration and necrosis in a putrescent focus underwent calcification and formed the nucleus around which cementum was laid down.

jected to any decalcifying process and it presented no obstruction to the cutting knife in the preparation of the sections, for the innumerable cementicles contained in this tissue were still uncalcified or only partially calcified. They show all variations in size and shape. A roundish or oval form is in preponderance in the larger cementicles. These are also the ones that exhibit the arrangement of concentric layers of primary cementum about a nucleus consisting of connective-

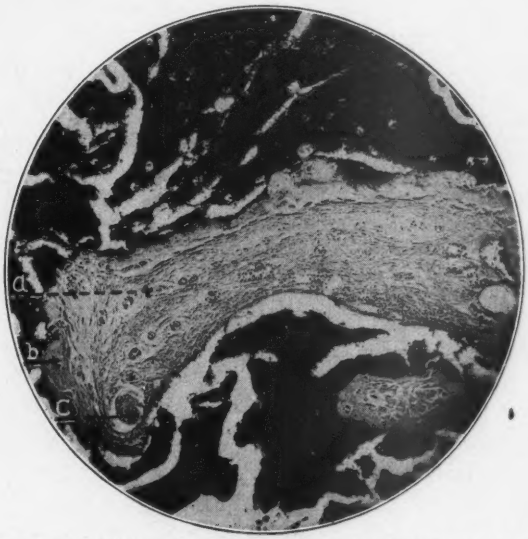

Fig. 7.—*a*, large space filled with very vascular connective tissue; *b*, precementum; *c*, nerve fiber cut transversely.

The mode of development of a cementoma from cementicles is well illustrated in the tumor which I am now ready to describe. The initial stages are seen in the youngest portion; namely, at the periphery on that side of the tumor which is toward the bottom of the alveolus. This tissue, which looked like a membrane, was removed separately after the tumor had been excised. It was not subtissue cells, which are no other than the cells of which the entire tissue is composed. (Figs. 4-5.) As the cementicles grow by peripheral expansion, they come in contact with adjacent enlarging cementicles and fuse with them. The more or less solid mass of the cementoma is nothing but a conglomeration of innumerable cementicles. (Fig. 6.) In the intervening wedges, the autochthonous

connective tissue continues to lay down new layers of cementum on the free surfaces of adjoining cementicles, thereby somewhat obscuring their original outlines as well as the concentric arrangement of the lamellae. (Fig. 7.) The mosaic-like structure exhibiting closely set roundish, onion-like or shelllike bodies will thus finally give way to that of a solid mass of cementum, the lamellae of which apparently are not concentric. (Fig. 8.) In fact, in some areas along the border of the cementoma, one can see lamellae laid down exactly like the circumferential lamellae of cortical bone. (Fig. 9.) These parallel lamellae bear a strong resemblance to fibrillar primary cementum also in the almost complete absence of cement lacunae. Only one lacuna is seen in this field. The striking similarity between the cementum in this neoplastic tissue and the primary cementum covering a tooth root is particularly well brought out in a higher magnification of a cementicle in the membrane. (Fig. 10.) The fibrillar structure of the outer zone of this cementicle is the same as that primarily laid down on the dentin of the root of a tooth, and cement lacunae are absent in this layer just as in primary root cementum.

In the membrane, the fibrocellular tissue forms the stroma or main tissue in which the numerous disseminated cementicles are embedded. In the tumor mass itself, the connective tissue forms smaller and larger areas between the fused cementicles which are not unlike the medullary spaces in bone. Active cementum formation was taking place in most of these spaces as evidenced by the

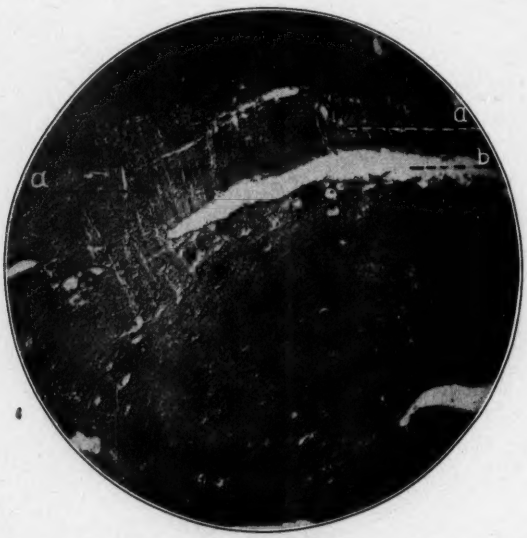

Fig. 8.—Solid mass of cementum. *a*, uncalcified Sharpey's fibers; *b*, fissure indicating greater brittleness of tissue, evidenced by enlargement of numerous cementum lacunae in this region.

presence of more or less wide zones of cementoid tissue along their margins. This connective tissue is cellular and very vascular. An interesting feature in one of these spaces is the presence of a nerve cut transversely. (Fig. 7.)

Rarefying processes are in evidence in various regions of the cementoma, presumably where the cementum is oldest. In such areas, the cementum lacunae become very large; the nuclei are greatly reduced or absent, and the spaces are filled with an areolar structure or appear empty. The cementum itself loses its density, appears finely porous and evidently becomes brittle in this rarefying process, as the numerous clefts and separation lines in such areas would indicate. This process is perhaps similar to that observed in bone which has been referred to by Westin[8] as "inner resorption." Apparently also, lacunar absorption has taken place in this tumor, for there are numerous characteristic lacunar outlines throughout the tissue, while typical large mononucleated or multinucleated osteoclasts could nowhere be found. We may assume that if lacunar absorption did take place by the activity of cells, it was achieved by the small spindle-shaped type of osteoclast. Also the cells that act as cementoblasts throughout this tissue are of the flat spindle-shaped type, with the long axis parallel to the surface on which new ce-

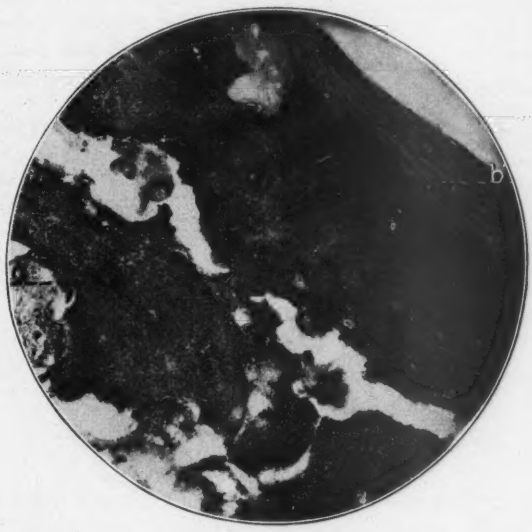

Fig. 9.—*a*, older cementum, slightly rarefying; *b*, more recent primary cementum laid down along surface.

8. Weston, G.: Beiträge zur Kenntnis des Hartsubstanzumbaus im Zahn- und Kieferknochen unter besonderer Berücksichtigung der Histopathologie und Aetiologie der Karies, Svensk Tandlakaretidskr., 1926, No. 4.

mentum is laid down. As these cells become included in the newly formed cementum, they increase in size and assume the form of cementum corpuscles lying in their lacunae. Not rarely, two cementum corpuscles are seen in one lacuna.

There is no evidence whatever of an inflammatory condition in this tumor and its membrane. All cellular elements associated with acute or chronic inflammatory processes are lacking, and the good supply of blood vessels in the connective tissue spaces within the tumor is simply that observed whenever active formation of bone or bonelike substances takes place. It is in no way a state of hyperemia. Infection from the periapical region apparently played no part in the development of this tumor-like structure.

One of the striking features in sections of this tumor are the numerous cracks and clefts. Fissures are seen especially at the junction of parallel layers. Cracks run at right angles to the surface of the lamellae. Euler and Meyer have called attention to these cracks and clefts, which, they state, are almost always found in nonstructural cementicles. The common explanation that they are artefacts arising in the preparation of the tissue for microscopic work is not proved, these writers assert, for they occur not only regularly, but also in protected areas in preparations that are otherwise intact. In Figure 10, we see part of an oblong, kidney-shaped cementicle with a crack that divides it into two equal halves. There are indications that this crack occurred *intra vitam,* although it is possible that the space widened during the process of preparation. We see the outer primary cementum continued over the fractured surface; and also some of

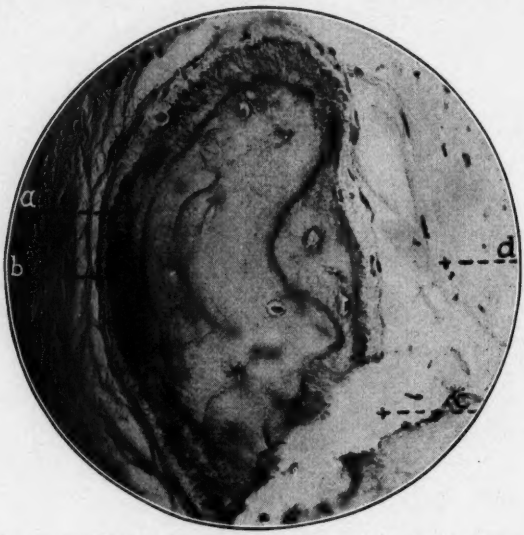

Fig. 10.—Higher magnification of cementicle in peripheral growing portion of tissue. *a,* outer layer of typical primary cementum; *b,* layer of cementoblasts; *c,* crack in center of kidney-shaped cementicle; *d,* very loose connective tissue also invading crack.

the very loose connective tissue that is present along the one side of the cementicle can be observed in the space.

CONCLUSION

Reference may be made to statements, especially from some English writers, suggesting a possible relationship between the occurrence of these tumors and rickets. Colyer[9] states that "there is at times a definite history of rickets," and according to Bland-Sutton, "there is good reason for the belief that rickets is responsible for some of the thickened capsules. . . . In some of the most typical examples which have been observed in human beings, the subjects were rickety children."

I am inclined to believe that this observation has no other significance than that a condition of very rare occurrence in some instances happened to be found in persons who also suffered from a wide-spread disease. Not so long ago, namely, before the vitamin question became a vital issue in hygiene and therapeutics, rickets was very prevalent, possibly particularly so in England. On the continent, the disease formerly was commonly called the "English disease." In view of this fact, it would, on the contrary, seem rather surprising that cementomas are not more frequent. The alleged relationship between rickets and cementomas also leaves us at a loss as to how to explain the isolated and frankly localized tendency to thickening and calcification on the part of the dental follicle, while rickets is a generalized disease. May we not rather assume that, as in so many other instances of localized proliferative and neoplastic tendencies, there is an inherent disposition for abnormal thickening and cement formation in a tissue at a particular locality, and an intercurrent condition of irritation simply furnishes the impulse for the manifestation of this latent tendency?

9. Colyer, J. F.: Dental Surgery and Pathology, London: Ed. 5, 1923.

ABUTMENT PREPARATIONS*

By DONALD E. SMITH, D.D.S., Los Angeles, Calif.

IN general, a dental bridge is composed of two parts; the pontics, which represent the primary functioning elements of the bridge, and the abutments.

This paper shall be limited to a consideration of the problems confronting the operator in his selection of abutment preparations from the various designs now available.

The fundamentals of abutments are relatively simple. They must possess maximum strength and stability with a minimum destruction of tooth structure. They must not needlessly jeopardize the health of the pulp or adjacent tissues; rather, they must promote health. Aside from the latter considerations, we are confronted with a definite mechanical problem as well as an ever-present esthetic consideration. From the standpoint of esthetics, we should strive, by all possible

*Read before the Section on Partial Dentures, Crown and Bridge at the Midwinter Clinic of the Chicago Dental Society, Feb. 3, 1931.

means to minimize the objectionable display of gold, but we should keep in mind that the loss of a tooth is a catastrophe, carrying with it loss of function as well as of esthetic values.

The safeguarding of remaining structures is our paramount responsibility, even though appearances may be jeopardized. Strong and thoroughly reliable abutments can be designed without undue display of gold and with the possibility of pulp involvement reduced to almost a negligible consideration.

The actual strength of a tooth is represented largely by the dentin, which also represents what is commonly considered the living structure of the crown. This must be borne in mind as we design our abutment preparations.

There are two types of abutments employed in making attachments to teeth: the inlay type, in which, by various means of retention, a casting is inserted in the tooth, and, secondly, an overlay or veneer, of either a portion of or the entire crown. A combination of these two types constitutes a third. This third type is preferred when its use is practical.

Inlays are distinctly limited in their usefulness as abutments for bridgework. Almost from their inception, they have been extensively used, and this indiscriminate use has undoubtedly been the outstanding cause of abutment failures in bridgework. In spite of this fact, many operators continue to use this design almost universally.

A careful consideration of these failures in apparently well made cases can only bring us to the conclusion that, fundamentally, the principle is not entirely sound. Inlays, to give sufficient bulk of metal, necessitate considerable destruction of dentin in a location that distinctly tends to weaken the tooth and, in effect, we have a veritable crowbar, which may spring the dentin, breaking the cement joint, or even going so far as to cause a fracture.

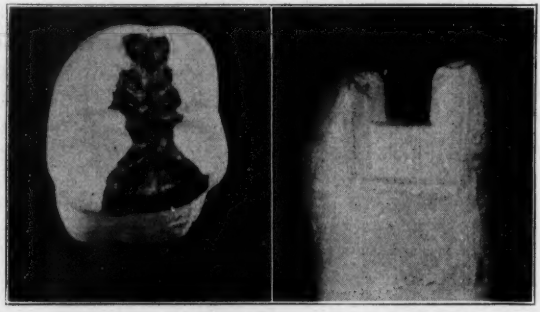

Fig. 1.—Inlay abutment with insufficient bulk of gold.

Even though the inlay may not be dislodged, the breaking of the cement joint means speedy failure, as a result of the pumping action which is instituted. There are none of us who have not seen the extensive inroads of caries, particularly about the proximal portion of many of these inlay abutments.

With the aid of Figure 1, it will not require any great degree of imagination for us to realize what is taking place in all too many of these cases. The small bulk of gold which passes between the mesial cusps is called on to carry a terrific load. Under this stress, it bends and the cement joint of the proximal surface is broken; and, when stress is brought to bear on the pontic, we can imagine this joint opening and closing, and food entering to promote rapid caries. Have we not all seen cases in which the patient complained of pain whenever he attempted to masticate solid food on such bridges? Is it not a logical deduction that this action is taking place, and does not the common failure of inlay abutments in this region bear out this deduction?

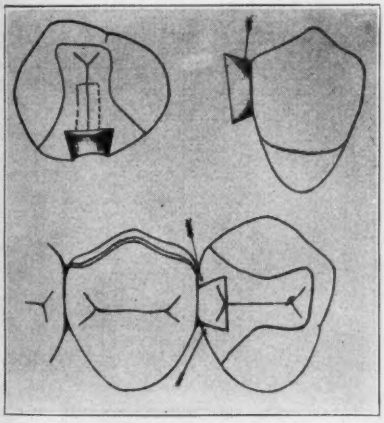

Fig. 2.—Clinched-dovetail stressbreaker.

It can easily be imagined that the stress brought to bear on the pontics is making a wedge and a crowbar of the occlusal portions of these inlays and springing the teeth. Complete dislodgment may not take place, but once the cement joint is broken in any part, they immediately begin to fail.

Inlays are indicated in many cases, but cases must of necessity call for small abutments or the stresses must be relatively light. By careful designing we may modify the design of inlay preparations to meet the requirements of these certain cases. We must make all effort to conserve the natural strength of the tooth and so design the body of the gold that the possibilities that we have mentioned are minimized.

The Class 2 type of inlay should be used only in conjunction with broken stress. Scientifically designed stress-breakers properly applied can greatly minimize the possibility of partial or complete dislodgment of this type of abutment. I might here mention that my conception of a stress-breaker is one that is just as nearly rigid, yet not rigid, as we can design. Much can be said regarding stress-breakers. All too often, they are injudiciously used without proper consideration of stresses and their ultimate effects.

Stress-breakers, as a general rule, should be placed on the smaller or weaker abutment and toward the mesial aspect. This is self-evident when we recall that, in posterior cases, bicuspids usually serve as the mesial abutment. A consideration of broken stress is a little off our subject, yet we cannot consider the application of inlays without giving it some consideration.

The type shown in Figure 2 has been selected over all other designs because it has this quality of being as nearly rigid, yet not rigid, as we can design it. This is known to us as the clinched-dovetail type of stress-breaker. A modification of the same principle, when used to make possible the placing of bridges on malalined teeth, is known as a solderless-joint, for we do not here desire flexibility.

I wish to make it clear that we use broken-stress for its mechanical advantages and not to overcome any imagined objections to the rigid type of bridge. The longer bridges in particular are more successful when made rigid. The feature of relieving the lug in the shaded area and the clinching of the lips preclude occlusal movement. Some may imagine that we have an absolute lock, but this is not the case, as the design of the dovetail must give a limited movement. It is slight movement which relieves the terrific strain on the abutments. Many years of observation of these cases bears out this conclusion.

A typical indication for a bridge using the inlay type of abutment is the restoration of either the upper or the lower second bicuspid. In this case, proximoclusal or mesioclusodistal inlays, especially modified for use as bridge abutments, are used, the stress-breaker being placed on the bicuspid inlay.

The presence of caries or previously placed restorations is an all important factor in the determination of the type of abutment preparation to be used, and it must always lie with the operator to make his selection consistent with the existing condition of the tooth.

Inlays should be used only in teeth which have not suffered extensive inroads from caries. The cusps must be supported with healthy dentin. Weakening of cusps becomes an immediate indication for the partial veneer type of abutment.

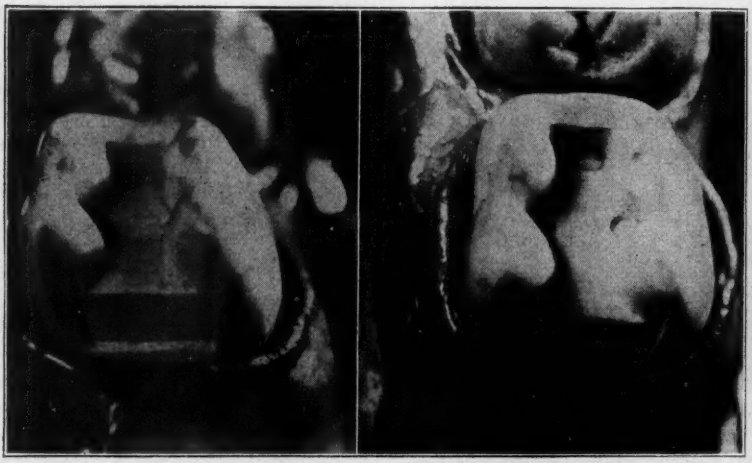

Fig. 3.—Class 2 bridge abutment.

The typical inlay preparation must be modified to meet certain requirements as a bridge abutment. The ordinary inlay, which will satisfactorily restore a carious tooth, is not qualified to bear the additional load that would be thrown on it in bridgework.

As the dentin represents the greater strength factor of the tooth, we endeavor to obtain bulk of metal at the expense of the enamel. A general rule is "maxi-

mum extension of outline form." This does not mean maximum destruction, as this extension is carried out largely by long bevels, made at the expense of the surface of the tooth. The proximal box form is cut shallow. The weakest point of this type of preparation is where the occlusal portion passes over to the proximal. Too often, there is failure to obtain sufficient bulk of metal in this region to assure stability. The springing or bending here is the outstanding cause of failure. Wide flares made at the expense of the enamel and extending well to the crest of the cusps give the much needed bulk of metal and, by the greater width, the inlay's acting as a wedge or crowbar. This designing also lessens the possibility of the springing or bending of the inlay itself, and it is accomplished without undue sacrifice of dentin, the real source of strength of the tooth.

The same principles apply to the bicuspid and to mesioclusodistal inlays, if they are necessitated.

I do not believe that keying is of much value. The cutting of holes for pins and keys is a hazardous proposition.

Preference for the partial veneer type of preparation has already been expressed. We do not fail to recognize the esthetic limitations, but there are so many ad-

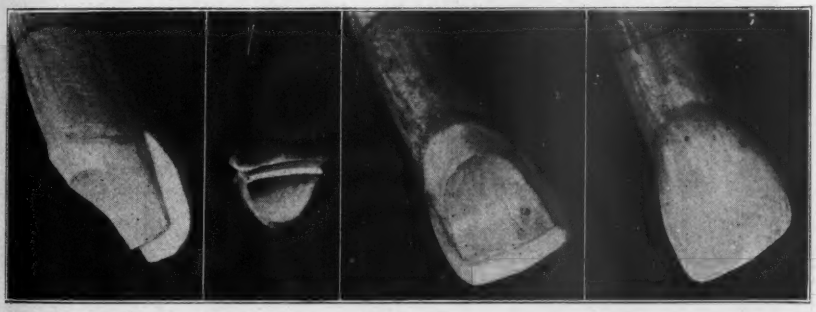

Fig. 4.—Incisor three-quarter crown.

lend stability. As we pass from this region to the central fossa of the tooth, the cavity immediately assumes the usual flare which means so much in frictional retention. We take full advantage of dovetail form without extensive cutting in the region of the triangular ridges, and by the use of slight countersinks in the region of the buccal and lingual grooves and in the distal fossa, we greatly increase the retention. Long bevels are employed throughout the preparation. It can be readily seen that this buccolingual width of the inlay must greatly enhance the stability and reduce the possibility of

vantages in this type of preparation that this objection becomes almost insignificant. Above all other considerations, the health and integrity of the teeth that are used as abutments must be conserved. Otherwise, bridgework must be condemned. We cannot justify the endangering of remaining teeth.

In general, there are two types of partial veneers. First, there are those commonly known as three-quarter crown preparations, which have become standardized in design. The typical three-quarter crown, in the anterior teeth, involves all surfaces but the labial, while,

in the upper posterior region, it involves all but the buccal. In the lower molars, the order is sometimes reversed, and we have all but the lingual surfaces involved. The other type of partial veneer and one that has rapidly been increasing in popularity because of its many advantages is what might be called the proximal veneer or proximal half-crown. Mechanically, this type has a distinct advantage in the conservation of tooth structure: the simplicity of preparation, the fact that it is prepared practically within the enamel only and its effect in locking the tooth more firmly together.

Fig. 5.—Cuspid three-quarter crown.

Diagnosis must be thorough. All existing conditions must be known before abutment selection can be intelligently made. Roentgenograms must give us positive knowledge as to the possibilities of caries in the region of contact points.

The typical three-quarter crown on a posterior tooth necessitates the cutting away of both proximal surfaces. By the very nature of the anatomic forms of teeth, this will require extensive destruction of tooth structure. The greater mesiodistal diameter of the tooth in the region of the contact points over that of the neck is responsible. With the proximal half-crown, one of these surfaces is conserved. It must be admitted that a normal proximal surface, with normal contact, free from caries, is safer and more desirable than a surface composed of gold. Bear in mind that we recognize the three-quarter crown, properly prepared, to be one of the finest and most widely used abutments, and it must be the abutment of choice in many cases. There are cases in which the three-quarter crown is being used when we would have a much safer and mechanically more suitable abutment were we to use the proximal veneer type.

The typical three-quarter crown conservatively prepared is the abutment of choice for all anterior teeth. Occasionally, we may make use of an inlay with a stress-breaker, but for sound vital teeth, time has proved the success of the skilfully prepared three-quarter crown.

The universal acceptance of the principle of the finish line, knife margin or shoulderless type, as it may be called, has led to greater safety in conservation of tooth structure.

A review of the literature of recent years pertaining to the preparation of the anterior three-quarter crown leads one to the conclusion that this particular preparation has become universally standardized. Occasionally, we hear some differences of opinion concerning the use of the incisal groove. No doubt, as we often see the principle applied, it should be condemned, but when used as advocated, it plays a vital part in lending rigidity to the casting, giving additional bulk of metal where the stress is heaviest and acting as a definite wall against incisal stresses.

The preparation of an anterior three-quarter crown will call forth all the skill of the operator. If more of these cases

were skilfully made, we would hear little of thimble crowns, pinledges and other preparations falling in this category.

When full advantage is taken of the possibilities of the three-quarter crown from the esthetic standpoint, in by far the majority of cases there is no objectionable display of gold. There is no other principle incorporating the factors of safety and sound practice that can be universally employed on anterior teeth.

In this discussion, the assumption is that the teeth are sound. It would be impossible, in the time alloted to even mention the multiplicity of methods that may be used on carious, broken down or pulpless teeth. Our greatest care is for the normal sound teeth that we jeopardize in the placing of our bridgework.

We might here mention some of the common causes of failure in anterior three-quarter crowns. Mechanically, this attachment is locked by slightly convergent proximal grooves which are located just beneath the labial plate of enamel, extending well down toward the cemento-enamel junction to give a firm lock about the cingulum. Too many of

Fig. 6.—Upper bicuspid three-quarter crown.

Fig. 7.—Upper molar three-quarter veneer crown.

these attachments are locked over the incisal and middle third only. This, an outstanding cause of failure, is most commonly seen on the opposite side from the pontics when the operator has met with an approximating tooth and a high gum line.

three-quarter, is used for the same mechanical advantages. The proximal grooves are so placed in the buccal cusps that the buccal and lingual cusps are locked firmly together. The additional metal afforded by the occlusal groove, which runs across the lingual slopes of

Fig. 8.—Typical upper molar.

Fig. 9.—Upper molar half-crown or proximal veneer crown.

Fundamentally, the posterior three-quarter crown is not unlike the anterior. The same grooving principles, including the occlusal groove, which is the counterpart of the incisal groove in the anterior

the buccal cusps, lends important strength in a region of heavy stresses. The finish line principle is used throughout. Grooves are comparatively shallow so that the preparation lies practically within the

enamel. By skilful cutting, the normal contour of the buccal surface is maintained, and there need be no objectionable display of gold. This preparation is undoubtedly the best and most widely adaptable for the upper bicuspids.

In the upper first molar, the three-quarter crown will be the selected preparation in the majority of cases where a strong abutment is desired. Mechanically, we believe that the proximal veneer or proximal half-crown is better adapted to the anatomic nature of this tooth, but the extensive display of gold on the mesiobuccal cusp, which is conspicuous in the majority of patients, will preclude its use.

Fig. 10.—Cuspid half-crown.

The preparing of the molar three-quarter crown is a trying ordeal as this tooth is large and a great deal of enamel must be removed. Identically the same principle as that just shown on the bicuspid is used. Tooth structure may be conserved by the raising of the lingual margin, the degree of this extension being determined by the extent of the stress to be brought on the abutment. In so large a tooth, it is seldom necessary that this margin be carried below the middle third to give adequate strength for any bridge it might carry. The natural horseshoe shape due to the large lingual cusps give a natural locking effect about the bulk of the crown so that proximal grooves may be made shallow. The occlusal groove follows the contours over the buccal cusp, maintaining a uniform depth and distance from the crests. The finishing line of the occlusal surface is carried just beyond the break of the occlusal to the buccal surface. Improved casting technic, whereby these large castings may be accurately made, has simplified and increased the usefulness of the molar three-quarter crown.

This preparation may be used on second or third molars. We here prefer the proximal veneer for its greater mechanical advantages, conservation and simplicity in preparing. Few people display the mesiobuccal cusp of the second or third molar.

An outstanding characteristic of the upper molar is the marked reduction of the mesiodistal diameter of the buccal surface in the region of the neck, that characteristic which complicates the making of three-quarter crowns and may jeopardize the pulp through deep cutting of the proximal grooves.

Viewing the same tooth from the mesial aspect, we observe that the buccal and lingual surfaces are, in general, slightly convergent toward the occlusal. By making the preparation around this proximal surface, placing grooves in the natural buccal and lingual grooves, we avoid the necessity of deeply cutting into the dentin and are working in an area remote from the pulp. Furthermore, we are accomplishing an important consideration in locking the buccal and lingual portions of the tooth firmly together. Occlusally, we remove approximately the thickness of the enamel over the region of the mesial cusps. The distal cusps, if in occlusion, are undisturbed.

A shallow inlay-like preparation is carried through the occlusal surface, ending in a slight countersink in the distal pit. This slight inlay feature lends rigidity. The finish line principle is carried throughout. The buccal and lingual grooves are carried over and into the inlay portion. These grooves must, of course, be placed in the same plane and be slightly convergent, to afford mechanical retention.

In a brief analysis of this preparation, we really find it to be a combination of inlay, crown and three-quarter principles, employing to greatest advantage the virtues of each. The part of the preparation overlying the mesial cusps and extending to the grooves is the same as that of a crown. The occlusal portion resembles a shallow inlay and the grooves give us the locking effect of the three-quarter crown.

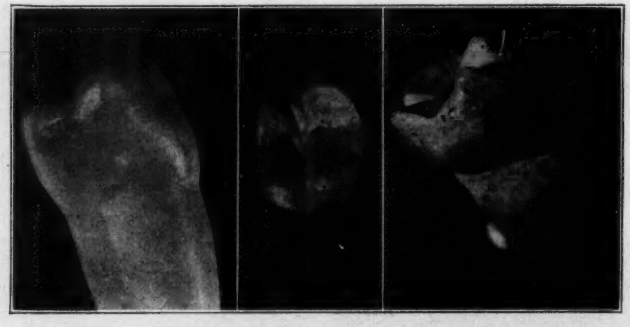

Fig. 11.—Half-crown as applied to lower second cuspid.

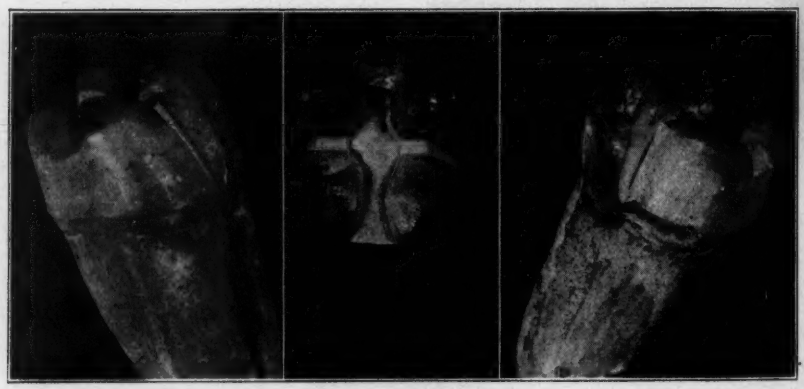

Fig. 12.—Lower molar half-crown.

Instrumentation for this preparation is simple. All operating surfaces are exposed to view and the entire preparation may be made with good quality small

mounted stones. It is essential that the preparation be carried well down about the gingiva to give maximum retention. The domelike form of the gold is mechanically the strongest design that can be used. Are we not justified in our preference for this abutment when we carefully consider its mechanical advantages, by which the possibility of the springing of the tooth structure or of the gold shell is practically abolished?

The upper third molar with its many anatomic variations is a tooth for which we must select preparations according to the particular anatomic characteristics that it may display. To those teeth having small occlusal surfaces and a relatively large circumference at the neck, the full finish line crown preparation is well adapted. In other cases where this tooth resembles the first and second molars, we find the half-crown well adapted. The gum tissue on the distal aspect which usually comes well up toward the occlusal third is an impediment to the cutting of this surface, not to mention the difficulty of getting instruments in position to work in this region.

Fig. 13.—Typical case for half-crown abutment.

It is relatively easy to prepare the half-crown, and the distal inclination of the tooth itself may be easily offset by the proper placing of our grooves. The preparation should be carried well around a large portion of the crown. Future scaling and prophylactic measures on the distal areas of this tooth are not complicated by gold margins, a fact worthy of consideration in the use of this preparation.

It might be well to emphasize further the ease with which the natural misalinement of upper teeth may be corrected. Often, where three-quarter crowns are used, the distal surface must be cut dangerously to permit the preparation to shed with the mesial abutment.

As we pass to the lower arch, we find the three-quarter crown the abutment of choice for the anterior teeth. Often, in the characteristic misalinement of the lower cuspids, the half-crown may be used to advantage. By its use, we are often able to simplify our problem, display less gold and, with ease, correct an awkward alinement.

The peculiar anatomic form of the lower first bicuspid, with its small lingual cusp and its crown bent lingually on the long axis of the tooth, calls on the ingenuity of the operator in designing a three-quarter crown preparation in accordance with the anatomic peculiarity. The tooth itself is small and may be called on to carry heavy stresses. We make it a general rule to come up and over the buccal cusp, the extent to which we involve this buccal surface of the cusp being dependent on the inherent strength required. In some malposition of this tooth, we may advantageously employ the half-crown principle.

The lower second bicuspid lends itself well to either the three-quarter crown preparation or the half-crown. In ordinary speech, as the mesial surface is quite conspicuous, the three-quarter crown may give an objectionable display of gold.

Light reflections from this gold are cast directly back to the observer.

In those cases having tight normal contacts, the proximal half-crown about the distal portion of this tooth not only gives splendid retention but also, by not involving the mesial portion, minimizes the display of gold. We find that this lower second bicuspid lends itself exceptionally well to this type of partial veneer preparation. Reflections of gold from the buccal surface are cast against the cheek, and, being in the shadows, are not exposed to view.

As a preparation for the lower molars, the proximal veneer is universally applicable. It may be used with equal facility on either the mesial or distal aspect of the lower first molar and is readily modified to meet the variations of stress. Instrumentation is accomplished with relative ease.

We are often confronted with the characteristic tilting forward and lingually of the molars. It is in these cases that we have a most satisfactory application of the half-crown.

The preparation is easily made to "shed" with the other abutments, this being accomplished simply by the proper alinement of the grooves. Dangerous cutting of the proximal surface is unnecessary as it is well to stop this margin where it will be accessible to the toothbrush and the washing action of the saliva.

Correction of articulation is merely a matter of building up the occlusal surface.

The full cast crown is an abutment which undoubtedly gives a maximum of retention. Hence, it has its greatest application in teeth of such anatomic form that the making of the preparation will not necessitate hazardous cutting.

Such teeth are those having large necks and relatively small occlusal surfaces. In bell-shaped crowns, tooth structures may be conserved by stopping the buccal and lingual margins well up on the convex surface.

Fig. 14.—Half-crown on tilted lower molar.

I strongly advocate direct technic in the taking of wax patterns for abutments, wherever possible. The operator, working direct, must acquire skill in the manipulation of matrices. It is comparatively easy to obtain well-adapted wax patterns which, when cast, taking full advantage of wax expansion and the use of more recently developed expanding investments, give exceptionally accurate results.

In closing, I wish to appeal further for a more nearly universal application of the various modifications of partial veneers because of their many fundamental advantages and time-proven success.

INFLUENCE OF DENTAL EDUCATION ON PROFESSIONAL PROGRESS AND ATTAINMENTS*

By J. BEN ROBINSON, D.D.S., F.A.C.D., Baltimore, Md.

WHEN we review the history of dentistry and become more intimately acquainted with the factors in its development, we are impressed with the influence dental education has exerted in promoting the present quality and usefulness of dental service. Each of us is interested in dental education because of its profound influence on the continued improvement of professional knowledge and its contribution to the immediate success of the individual members of the profession. Dentistry, as it exists today, represents not mere casual conditions, but is a composite picture of many ideals and an ever-increasing store of knowledge brought together through various educative processes. These are contributions of a vast array of professional forbears who have, through other ages, especially the past nine decades, moved across the stage of our professional life.

To trace all these contributions back to their sources would perhaps not justify the required expenditure of time and energy. It is sufficient to recognize their existence and the value of such contributions to our store of knowledge. The present status of dentistry represents the sum of all processes by means of which our profession has transmitted to successive generations its acquired powers and store of knowledge with a view of perpetuating its own existence and growth.

> The present contains all that there is. It is holy ground, for it is the past, and it is the future. At the same time, it must be observed that an age is no less past if it existed 200 years ago than if it existed 2,000 years ago. Do not be deceived by the pedantry of dates. The ages of Shakespeare and of Moliere are no less past than are the ages of Sophocles and Virgil. The communion of saints is a great and inspiring assemblage, but it has only one possible hall of meeting, and that is the present; and the mere lapse of time through which any particular group of saints must travel to reach the meeting place, makes very little difference.[1]

It is this view of dentistry that we are invited to study, to analyze, to evaluate, and, having assessed it, we are invited to adjust ourselves to that place in the profession which offers the best opportunity for service, and contribute our influence to an improved educational system, that our heritage may be enriched in behalf of the present good and for the benefit of those who are to follow, in the years to come.

All vocations when analyzed reveal the dual existence of a basic science and a developed art. These may be portrayed

*Read before the North Carolina Dental Society, Winston-Salem, May 6, 1931.

1. Whitehead, A. N.: Aims of Education, and Other Essays, New York; The Macmillan Company, 1929.

by reference to certain occupations which illustrate this dual relation. The art of farming has been practiced for ages: it is but recently that the science of agriculture has become established through the discoveries of research. The art of medicine is as old as the human race, having existed among the ancients in every civilization, but its science has more recently attained its present high order. We recognize the science of medicine and the physicians' art, the science of agriculture and the art of farming, the science of architecture and the art of building, the science of dentistry and the dentists' art; etc. Chronologically, art has always preceded science, but the order is reversed in education once a science is established. While these two aspects of all enterprise are demonstrable, they cannot be separated. The development and perfection of one depends on proper attention to the demands of the other. It is, therefore, necessary that this dual relation be recognized, if we would successfully solve the dental educational problems of today for the improvement of opportunities for those of tomorrow.

Philosophy may be regarded as a search for first principles, or that science which undertakes to explain facts and existence with their causes and laws. The philosophy of a profession may be discovered in a study of the history of its education with reference to the influences which have determined the present character of its standards of professional education. Because of its importance and an improved appreciation for our dental philosophy, a brief review of the history of dental education would seem desirable.

The dental art had its beginning in the dawn of human history and originated in response to the necessity for relief from suffering. History can fix no exact period as the beginning of dentistry since the practice of the dental art seems to have existed in prehistoric times. We are reasonably sure that the beginning falls within that period of development of the human race known as the "instinctive epoch," or the epoch when primitive man instinctively invented means for securing comfort and self-protection. The first effort to provide relief from oral discomfort was no doubt concurrent with the beginning of general medicine, which is shown to have existed in the earliest historic records of all ancient people, and which, we conclude, existed in a crude form in prehistoric times. As the light of civilization appeared in the various parts of the world, the dental art emerged as a division of the medical cult, and for centuries its practice was regarded as an integral part of the physicians' art. As men grew in intelligence, the mind intuitively turned toward the Great Light, and the worship of deities ushered in the "theologic age," which had such a profound influence on the trend of civilization, including the progress and development of medical science. During this period, the practice of healing was in the hands of priests, who represented themselves as emissaries of the gods and who acted as mediaries between them and those suffering from physical ailments. Bodily ills were interpreted as manifestations of displeasure of the deities with the suffering individual. Interpretation of etiologic factors, prognosis and treatment of disease was hopelessly bound up with superstition and ignorance, while the afflicted were treated principally by invoking the aid of the gods.

Through the accumulation of knowledge recorded by priests in their ministrations, there developed an empiric system of medicine which was the primitive art

in which we are today interested. This was the beginning of empiricism in health service, which has persisted down through the ages and a vestige of which remains to this day alike in medicine and dentistry. Through the early centuries of the ancient civilizations, knowledge developed as men responded to the inexplainable urge for intellectual adventure and exploration—that necessary stimulus to discovery. As time passed and information increased, early philosophers devoted themselves to a study of fundamental principles in medicine; a harmony of thought appeared, and medical and dental art began to assume a quasiscientific standard. A great stimulus to advancing science in medicine appeared with the splendid interpretations of lay and sacerdotal medicine by Hippocrates of Greece, about 490 B.C. So profound was this contribution, it earned for its author the immortal title of the "Father of Medicine," and marked the beginning of the "scientific epoch" in medical history. Other important interpretations were made by Galen of Rome, 130-201 A.D., and Avicenna, an Arabian physician, 980-1037 A.D., which, to a degree, were amplifications of the Hippocratic canon. These interpretations, accepted as the basis of all medical teaching, were applied in the medical schools of the early universities, continuing to exercise a definite influence on medical education even to the present.

One would conclude that the advent of science in medicine would soon reform all practice and place the physicians' and dentists' art on a rational basis. But such was not yet to be. The science of medicine at once became the object of philosophic investigation, and soon became the property of the "intellectuals," which produced a gap between the science of medicine and the art of practice. The "intellectual" has always prided himself on his interest in "principles" for their own sake, and to qualify as a pure "intellectual," one must foreswear any interest in practical applications. The science of medicine was for centuries accepted as an essential part of philosophic study, and later of university discipline, but the physicians' art had no part in the scheme of medical education, nor was it correlated with developing science as a means of improving the physicians' art. Clinical application of medical science was left almost exclusively to the guild of surgeons which had developed among lay healers, Roman gymnasts and barbers. Pupils were apprenticed to masters of this guild and, in this capacity, developed the physicians' art of practice. Because of the growth of medical science along an independent course and the improvement of the physicians' art along another, each yet tending toward the other, it was but natural that the scientist and practitioner should ultimately come into conflict, which occurred in the eighteenth century when demonstration methods of instruction were introduced and clinical practice was made a part of the medical curriculum. While this change tended to improve conditions, it at the same time stimulated empiricism because of meager educational facilities and lack of regulation and control in medical practice.

Through a long period of evolution, the practice of dentistry was included in the surgeon's program and developed as a part of his art in response to human demands. This development slowly improved the scientific approach to efficient oral treatment. During ancient times and throughout almost all the medieval period, the science of dentistry received valuable contributions from many learned men who elected to pursue this special-

ty of medicine. A study of these contributions will show that they were the outgrowth of discoveries and applications of the surgeons, especially that small number interested in oral lesions, rather than of medically trained physicians. While there had ever been a tendency for dentistry to branch off as a specialty of medicine, as it existed in ancient Egypt, it was not until about the fourteenth century that so-called scientific dentistry diverged into a specialty recognized by the physician and surgeon.

From the time of Abulcasis (eleventh century of our era), until the advent of Guy de Chauliac (fourteenth century), history reveals but little progress in the art of dentistry, yet a change in the attitude toward its practice was quite impressive. Abulcasis proclaimed against the barbers' extracting teeth, contending such practice should be in the hands of the surgeons, while Guy de Chauliac readily admitted the need for the specialist. Guerini refers to this important recognition of the dentist by the latter as follows: "Before speaking of the special methods of cure of single dental affections, Guy observes that operations on the teeth are *particular* (proper) to barbers and to 'dentatores' to whom doctors have abandoned them."[2] So far as we are informed, this was the earliest recognition of dental autonomy as we know it.

While this reference to specialists seems to imply that dentistry was controlled by the incompetent class known as barbers, the further history of the specialty shows that many capable and highly esteemed men engaged in this calling. Horace H. Hayden referred to them as follows:

> In most foreign countries, those who have directed their attention to the study and practice of this branch of medicine are known as such by the medical faculty, and have been recognized under the legitimate and appropriate title of dental surgeon. Those whose diligent attention and talents were devoted to the acquirement of a correct and critical knowledge, as well of physiology and pathology, as of practical operations, were considered by the faculty of medical practiciens, as cultivators in the same field and whose opinions upon professional points were entitled to the most respectful deference and whose skill was, in many cases considered as essentially necessary as that of the general surgeon or physician.[3]

Pierre Fauchard is regarded as the founder of modern scientific dentistry. He lived and worked during the first half of the eighteenth century. He carefully analyzed the field of oral surgery and systematized its practice along scientific lines. He wrote fully from his scientific knowledge and experience, giving to the profession his contributions in two volumes in which he fully and completely discussed the science and art of dentistry with numerous references to unfavorable existing conditions then appertaining to the practice of dentistry. In one, he suggests, we believe for the first time, the necessity for a special system of education for the dentist. He also referred to licenses then granted candidates to practice dentistry in France, and in view of the fact that such examinations were in the hands of medical men, suggested the advisability of adding a dentist to such examining boards, a further recognition of the specialty of dentistry. These volumes on scientific dentistry were of great value as an educational opportunity and rank Fauchard as one of the greatest of all influences in the development of dental science.

2. Guerini, Vincenzo: History of Dentistry, Philadelphia: Lea & Febiger, 1909.

3. Hayden, H. H.: Am. J. Dent. Sc., 2: 9-15 (first series), 1841.

Following Fauchard came a long list of contributors who gave a literature which has been an invaluable aid to education in the early years of professional dentistry. Notable among these were Bourdet, Bunon, and Jourdain of France, Blake, Fox and John Hunter of England, the latter having made the greatest contribution to this time in his "Natural History of the Human Teeth," in 1771 and his "Practical Treatise on the Diseases of the Teeth," in 1778. Fox is reputed to have offered a series of lectures on dentistry to the medical class of Guy's Hospital, London, in the closing years of the eighteenth century and to have published them in the early years of the nineteenth century.

At the beginning of the nineteenth century, we find a condition of unusual interest in the character of oral service offered the public. The influence of centuries of empiricism and the unbridled gainful opportunities in this department of health service invited incompetents to engage in the field of dental practice, while the ever-increasing greed was becoming a potential factor in lowering the profession in public esteem. Disregard for the need of dental service by medical practitioners who went so far as to assume an attitude of disdain further discredited the practice of dentistry in the opinion of the public. A vivid description of these conditions may be found in an address by a pioneer American surgeon, S. P. Hullihen:

> Until within the last ten years—until the establishment of this college—the dental profession was looked upon as a *trade,* and its practitioners as mere mechanics; while gentlemen who devoted themselves to the treatment of the eye, the ear or skin, took rank at once with the physician or general surgeon. On what ground was this distinction predicated? By what authority was it sanctioned, and by whom promulgated? A disgraceful ignorance of medical science among the dental practitioners was the groundwork. The medical faculty were the willing accusers, and the untiring persecutors. They condemned, without stint, a calling they knew not how to practice, and a practice they knew not how to improve. Such of the faculty as were learned in their profession, were found always competent and fully prepared, to be oculists, aurists or lithotomists, or to devote themselves to any other branch of the profession which their interest, inclination or talents might determine, except that of dental surgery. This branch seemed to require something more than medical knowledge. It required great mechanical skill—"an education of the hand as well as of the head." A kind of education they had not received, and knew not where to acquire and yet affected to despise. The necessities of the community cried aloud to them for help—a help which they could not bestow. This drove many sufferers to seek dental aid out of the medical profession, and to obtain that help which mechanical genius alone could supply. At this, the profession seemed mortified and chagrined, and loudly mocked at those who dared to supply their delinquencies; and united as one man in deriding the uneducated dental mechanic. They first created the necessity for an empiric, and then croaked forth their withering contempt on the creature their own ignorance had made. Thus was the science of dental surgery neglected, and thus abused, and thus did it fall low down in the very depths of general disrepute.[4]

Let it be observed that there were great and good men in this period, but, as Hullihen said, "It is true, there were some noble exceptions—some proud examples of individual enterprise—of great talents and industry, bestowed, in every age, on the almost hopeless work of improving the dental profession. Yet the labor of such worthies served but little more than to raise themselves monuments of greatness for after generations to honor and admire." This was the picture of a condition that had been centuries in growing.

4. Address before the graduating class, Baltimore College of Dental Surgery, 1850.

Dr. Hullihen goes on to point out that the solution to this revolting condition was to be found in a plan for teaching both the science and the art of dentistry, to combine in the same person a thorough medical education and mechanical training. The one who first urged such a union of medical science and mechanical skill under proper educational opportunities and who labored so diligently in accomplishing his purpose was that distinguished American dentist, Horace H. Hayden. In entering on the practice of dentistry, Hayden, complying with his belief in the values of education, wisely mastered the medical sciences preliminary to engaging in what he regarded an important specialty of medicine. He believed that if dentistry were ever established in the esteem of the public, it would be when it commanded such esteem by the scientific attainments of those engaged in its practice. Because of his high professional ideals and unusual scientific attainments, he took equal rank with and was warmly welcomed by those members of the medical profession and the most learned men of all vocations whom he made contacts with in Baltimore, where he practiced for upwards of forty years.

The Maryland law governing the practice of medicine recognized dentistry, which was legally interpreted as a specialty of medicine, and, in 1810, Hayden received a license, the first in America, to practice dentistry. This license was granted by the medical examining board of the Medical and Chirurgical Faculty of Maryland. In 1816, he made the first effort to organize dentistry into an association for mutual benefit, continuing these efforts until his dreams were realized in 1840. From his arrival in Baltimore, about 1800, he engaged in teaching those who sought his instruction, until 1821, when he began lectures on dentistry to medical students in the School of Medicine, University of Maryland, continuing uninterruptedly, it is believed, until 1825, when discord and dissension precipitated a legal battle between the regents of the University of Maryland and a newly created board of trustees, which caused an interruption of these lectures. This, the first effort at dental teaching in America, was the beginning of that struggle for dental educational opportunities which culminated in the founding of the Baltimore College of Dental Surgery.

This legal fight between the regents and trustees was carried on until 1837, when the board of regents had their rights restored in a ruling by the supreme court of the State of Maryland, at which time the regents regained control of the university and, it is said, Hayden resumed his lectures. The University of Maryland was exhausted by this long legal battle, as shown by a reduction in enrolment from more than 400 students in 1825, to eighteen in 1839. Because of these conditions, it was but reasonable to expect the rejection of a request to create a chair of dental practice in the faculty of physic, University of Maryland. But the need for some system of training that would offer opportunity to those seeking to enter the dental profession had been recognized, the desire to provide it was not to be denied, and, in response to this great yearning, the Baltimore College of Dental Surgery was chartered, Feb. 1, 1840. Shortly before this event, the *American Journal of Dental Science* was founded as the first dental periodical in all history. In the summer of 1840, the American Society of Dental Surgeons was organized.

Dental periodic literature, organized dental education and organized profes-

sional interest simultaneously appeared, combining to usher in a new age in dentistry. Dental literature has multiplied by leaps and bounds; dental education has progressed in a most satisfactory fashion, while organized dentistry as a means of self-improvement to the practitioner has been an invaluable aid and is now indispensable. Today, we have a vast store of information reposing in our accumulated literature. There are thirty-eight dental schools in the United States and many others in all civilized countries contributing to the onward march of dental science and art. Dental organizations rank from the International Dental Congress to national organizations in various countries, the most important and impressive being the American Dental Association. Societies are formed in each of our states, various district societies in most states, and city organizations, on down to the small study groups, of which there are myriads. In addition, practically all countries and *all* of our states have licensing boards designed to protect the public through legal restraints. Truly, the progress and attainments of the dental profession have been marvelous. All of these functions are directly educational or aids to the educational program in which all of us are interested.

While dental educational institutions increased in numbers and improved in usefulness from the organization of the first college down through the years to the present, this progress was beset by many difficulties and discouraging elements. For many years after the founding of our professional independence, some of the evils of our empiric system of dental training persisted, finding fruitful employment in the new epoch. The most devastating condition was and still is the facile adaptation of the art of dentistry, even in educational institutions, to the purpose of exploitation. This fact was responsible for the appearance of a number of proprietary dental colleges, which sprang up without even reasonable claims to a semblance of pedagogic merit, but which could be regarded as good business ventures on the part of promoters. Such institutions exercised an unfavorable influence on the quality of professional attainment of those receiving training for work in an important branch of health service and resulted in an injury to the cause which still appreciably afflicts the profession.

For almost forty years after the founding of the first college, there was a pronounced conflict of ideas between the old and the new. Altruism and rationalism, which had ushered in a new era, were striving to move onward and upward. Selfishness and empiricism were the forces which retarded progress, persisting in carrying on, growing weaker, it is true, but continuing to exercise a baneful influence. During the greater part of this period of time, there were no affiliations of dental educational institutions nor any independent authoritative body to fix standards to which dental education should conform. The various schools designed their particular curriculums without regard to any standard of requirements and set up their individual standards of education, quite alike in main purpose, but so varied in administration and with such elasticity in ethics that the profession could not be looked on as recognizing a reputable standard of education or system of instruction. There were but few states in which legal restraints designed to regulate the practice of dentistry existed which, by virtue of such requirements for admission to practice, would tend to improve education.

In the early eighties, some of the dental schools of the United States organized for mutual educational benefits and, at the same time, the state boards of the various states formed a national organization designed to improve the quality of training of those anticipating the practice of dentistry. The result of these efforts was quite fruitful and, under these influences, we find dental education making substantial progress. Then came two important developments that were to result in the most valuable improvements since the founding of organized dental education. The first of these was the advent of the Dental Educational Council of America, which has had such a profound influence on the improvement of dental education. This body made its appearance in 1910. The council was composed of five members each from the National Dental Association, the National Association of Dental Examiners and the National Association of Dental Faculties. The object, in the words of Dr. Burton Lee Thorpe, the President of the N.D.A., "was the advancement of dental education and the unifying of the standards of the various national bodies of the dental profession; to inspect the various colleges under their jurisdiction with a view of ascertaining the character of the work done, and whether the needs of the community in which colleges exist are fully satisfied; to perfect a model curriculum and make a study of the existing dental laws of the various states, and present a report on the possibilities of more uniform dental laws."

In its early years, the Council encountered many difficulties in its efforts to secure a semblance of uniformity in educational standards. As time went on, the profession became aware of the necessity for standardization of educational functions and, through the persistent efforts of the Council, minimum requirements for admission were advanced, courses of instruction both as to length of time and relation of subjects were agreed on, and improvement in instruction and increase in facilities for clinical teaching were given form.

This was not the work of a day, but by devoted study and patient and persistent effort in the face of many prejudices, the influence of this body has contributed more to professional progress and improvement than any other single factor in our modern history unless it be the founding of a college, a literature and an association of dentists as the beginning of professional dentistry. The second great influence on standardization and the emancipation of dental education from unfavorable influences was the study of dental education in the United States and Canada and the report on this study made by the Carnegie Foundation in 1926. This has been and will continue to be regarded as of inestimable value. It has gone into the privacy of all the schools and brought forth and given a publicity to conditions that, while in some instances embarrassing, has been correspondingly beneficial. It has revealed dental education to the public and acquainted it with itself. In the revelation of certain weaknesses, strength has been instituted that offers to carry dental education to heights hardly dreamed of before.

The report has, without fear or favor, given the world facts as they exist in institutions of dental learning of the United States and Canada and, by so doing, has directed the attention of competent educational authorities to the claim of dental education in a manner that tends to permanently establish it in the scheme of higher education. There seems

every reason to believe that it will influence the removal of the last remains of the selfish and depressing influences over dental education which have persisted through the ages down to the present.

The aims of dental education are revealed in the object for which it was instituted; namely, to produce men with expert knowledge in a special field that they may be capable of satisfactorily and successfully meeting an important health demand, to maintain the profession in a healthy and progressive state and to add to the store of knowledge by intelligent attention to scientific investigation and improvements in the dental art. These objects may be attained in a telling manner only under conditions that guarantee quality in the product. Certain fixed policies should be followed to secure satisfactory results in our system of education: first, the admission of young men to study who possess to a high degree those natural qualities which, when developed, will make them fully capable of discharging the important duties implied in the demands on the profession. Such a person must present evidence of his scholastic capacity as attested by previous educational refinements, to the point that he shall fully meet the recognized minimum requirements for admission to study, and shall have shown by such intellectual effort a mental capacity of average high order.

The time is past when men may find entrée to dental educational opportunities through a vague desire "to be a dentist" or because they are "mechanically inclined." Dentistry is, or should be, a learned profession, and only those should be admitted to it who can present evidence of capacity to acquire useful knowledge and who possess talent that will develop into skill, both motor and intellectual, and finally but not least of all, those who display a tendency to acquire the ideals in life which should dominate behavior in professional relations. It is possible and perhaps desirable to go farther than the recorded facts of predental scholastic records to search for evidence that will establish the claims of the candidate to a professional educational opportunity. It may be necessary to demand scientific tests of his intellectual and mechanical abilities. Such measurements are employed in some professional schools and, in the near future, we will have valuable data available to guide all schools in this important and far-reaching venture. If, after admission, the student demonstrates reasonable capacity in the intellectual requirements and creative ability in coordination of knowledge and skill, his future success may be regarded as promising, and he may progress through the years to the profession to which he aspires. This selection of students for admission and the elimination through refusal to promote those who prove themselves unfit are the safeguard dental education can throw about the future. All professions have too many misfits, and it is the inferior person that the group is too often judged by. Dentistry must meet its solemn duty to the public and guarantee its future by carefully selecting those who are best qualified by nature and training to practice our specialty.

Secondly, the type and quality of dental teaching must be further improved. This is at once the most important and the most difficult task confronting us. In the progress of dental education, this important factor has received much attention by school administrators to the end that there has been significant improvement. It is most difficult to secure an instructor who possesses the requisite

combined professional knowledge and pedagogic training. Billroth says, "The only way to develop (in medicine) capable university teachers is to secure the most scientifically important men for the chairs and give them their opportunity."[5] The problem is to find instructors who combine both scientific and practical knowledge, who possess a modicum of pedagogic instinct, and who may, with these elemental requirements, give themselves their opportunity.

The successful teacher should direct his efforts to develop independence of thought and action in the student. It has been said, "Education is the acquisition of the art of the utilization of knowledge," and the student must be taught that he should acquire knowledge, but most of all acquire the art of its utilization. To teach facts, to create the monstrous spectacle of a mentality partitioned off and pigeonholed to retain so many facts and so many data is the most gruesome educational ideal. Again, education should be directed along lines to develop in the student the habit of study and investigation, and, in addition, to instil in him a desire for further self-education that he may, in the years to come, grow in intellectual strength and scientific attainments. We must not forget that an educational system never can develop a finished product. All that dental education aims to do is to give fundamentals and prepare the novice to "commence." A dash of inspiration to flavor our bulk of information will stimulate to greater efforts, and aid to eliminate that unfortunate condition of self-satisfaction so commonly the cause of a lack of interest on the part of our fellow practitioners, and, what is more important, will do much to efface that last vestige of empiricism which still haunts our profession.

In determining what shall be included in the dental curriculum, it is necessary to fix a time adequate to completing the education of candidates. This time is regulated in part by economic conditions, but has been governed more particularly by the amount of subject material to be offered in a curriculum to equip the student adequately with the fundamentals of medical and dental science, and to train him in rudimentary principles of the dental art. Since the factors involved in fixing a minimum time for the course are relative and have been argued from arbitrary premises, there is some justification for failure on the part of organized dentistry to adopt a uniform plan of education.

Experience in the study of dental education by competent members of the profession suggests five years after graduation from high school as the minimum time, but favors additional time requirements which any dental school finds possible and desirable. The minimum time can be determined in but one way, and that is found in the answer to the question, What shall be the qualifications of one to *begin* the practice of dentistry and how long will it take to produce such an agent? If the answer is determined by the time necessary to instruct the student in the fundamentals of professional knowledge and art, the courses to be offered must be arranged to harmonize with the time schedule. First, the predental course of study may be regarded as cultural, i. e., subjects that tend to improve intellectual refinements, and as utilitarian, i. e., those subjects including knowledge prerequisite to the study of the physical, medical and ancillary

5. Billroth, Theodor: Medical Science in German Universities, New York: The Macmillan Company, 1924

sciences, upon which the art of dentistry must be superimposed.

Secondly, the professional curriculum is regarded as utilitarian and includes the physical, medical and ancillary sciences and the practical application of scientific knowledge toward the development of the art of practice. The total of the cultural and the professional requirements must be provided for under a time arrangement, to be known as the minimum requirement for completing the course. All proposals for a solution of this problem should be to the end of better professional service. In any arrangement, we should not yield to the pedantry of culture, or the desire for knowledge that may be displayed rather than used. Professional education must determine what information is most worthwhile and forego that refinement whose sole claim is embellishment for appearances' sake that our vanity may be satisfied.

Not only is the time requirement of the dental course a question for debate, but also the apportionment of time to so-called cultural demands and professional requirements in various schools remains undecided. The present variance in opinion is not operating to the advantage of the profession. Dental education must solve this problem to the point where minimum time requirements will have similar plans and comparable apportionment of time between the cultural and professional subjects. The arguments pertaining to these differences have no place here, but the profession should realize the difficulty, grasp the situation and, having formed an intelligent opinion, use its influence to bring about a proper standardization in this important educational relation.

The third important factor in professional education is purely economic. We allude to the source of income necessary to carry on the important function of educating a group to perform a service to the public. Such support may be derived from the fees of students and profits from clinics, from endowments or from appropriation of public funds; or a combination of the three. It has been conclusively proved that no form of education can be made self-supporting because, if the student is taxed to satisfactorily support adequate physical facilities, equipment and instruction, the financial load will be so heavy that education under such a system will be prohibitive.

The former policy of dental education which depended on fees for maintenance was so unsatisfactory that proprietary dental schools were required to make changes when obliged to meet higher standards. When obtainable, endowments are the most reliable and satisfactory sources of revenue, but all institutions are not so blessed as to enjoy this fortunate position of endowment aid. In the absence of endowments, dental education becomes the responsibility of the state and should receive adequate maintenance comparable to that awarded other agencies on which the public depends. The state will respond to the appeal for aid as soon as dentistry intelligently presents its case, which must reveal a public spirited unselfishness responding to the appeals of suffering humanity.

All functions of our educational system cannot look for full state support. Such features as research, graduate and postgraduate demands, libraries and the perpetuation of the traditions of dentistry in museums and with memorials should be endowed. Not only should there be endowments to care for these important elements, but such endowments should come mainly from the profession. Every man owes something to his

profession and a part of one's wealth set aside to aid in perpetuating the profession to which one has devoted a long life of service is a worthy monument to the memory of any dentist. No greater problem confronts dentistry today than the question of maintenance of its educational institutions. It is unreasonable to assume that student fees can satisfy or that state aid can possibly make appropriations to meet the fullest need, but with the addition to these of a reasonable endowment from philanthropic dentists and laymen, the cause of dentistry may be amply provided for.

We would like to address a few words to certain zealous influences which seem dissatisfied with the present attainments of the profession and propose to revolutionize dentistry by merging it with conventional medicine. We introduce this thought because it is a problem for the profession to solve. The future relation of dental education to conventional medicine is engaging the attention of the dental world to a degree, some interest being manifested also by a very few medical friends. Shall dentistry continue as an autonomous division of health service or shall it be merged with medicine, becoming an accredited specialty of medicine? This question should be answered with only the best interest of the public in mind. The fundamental principles of medical science are essential to the educated dentist and, in addition, the ancillary sciences are imposed upon the dental profession as biomechanical factors intrinsically a part of dental art. Both the medical and the dental arts depend for success on a thorough understanding of the physical and biologic sciences. The physicians' art, based on these sciences, has developed in one direction. The dentists' art, influenced by the biomechanical factors, while based upon these sciences, has, in the very nature of the problems confronting the dentist, developed independently. The two have run parallel and have established some contacts of mutual value, but in the main are quite independent. Mastery of neither art is necessary to the successful performance of the other, but a knowledge of the physical and biologic sciences is essential to both. Without going into too much detail, we propose that a thorough training in the physicians' art is not necessary to a competent and scientific service, which dentistry is asked to render the public. The philosophy of both dentistry and medicine testifies to this conclusion. That dentistry has in some respects failed in its objective is no argument for a realinement, but rather a proof that greater attention should be directed to the physical and biologic sciences as a necessary background to higher standards in dentistry. This program should be supplemented by an effort to secure a change of ideals in both medicine and dentistry that a more sympathetic understanding between these health services be established, to the end of a more complete and satisfactory public service. In the main, those who question the capacity and ability of the modern dentist to serve the public in terms of scientific demands or who look on dentistry in a supercilious way as if to say, "Oh, Lord, I thank thee that I am not as other men," are, both in and out of the profession, those who themselves lack an understanding of the true ideals and potential capacity of our profession. These iconoclasts argue along lines of alleged deficiencies to be observed in dental education and practice and are wont to compare the best there is in medicine to the worst there is in dentistry, looking on the results of such comparison as proof that their theories must

be accepted. As far as our information goes, compelling proof of the desirability of complete medical training as a prerequisite to the practice of dentistry is sadly lacking. I shall leave this question by quoting from the writings of Chapin A. Harris, a medically trained dentist: "Whenever, therefore, I hear a person say that none except graduates in medicine are competent to discharge the duties of practitioner of dental surgery, I at once take it for granted that he himself is either ignorant of the profession, or wilfully intends to deceive, and in which case, I can regard him in no other light than as an imposter and empiric."[6]

Let us repeat, "The present contains all that there is." Our store of professional information represents a community of knowledge that has been age long in accumulating. But it is not a perfect picture; much is to be added year by year, if we would live on into the future. We are confronted with many problems seemingly as important and formidable as any age has known. We must not overlook the fact that each age has had its problems, and the future will bring to each succeeding generation tasks that will sustain professional interest and stimulate action, certainly equal to what we have known. We should approach our task with open-mindedness and desire for truth that will secure advantages to the present and insure greater success in our enterprise in generations to come. Selfish treatment of questions of principle does not possess even transient values and is as futile as it is foolish. Let us then give careful thought to an analysis of our status, and when its weaknesses are revealed, honestly endeavor to correct permanently or alter unfavorable conditions in a manner salutary to both the present and the future.

815 Medical Arts Building.

6. Harris, C. A.: Am. J. Dent. Sc., 1:52 (first series), 1839.

CONSERVATION APPLIED TO PERIODONTIA*

By GRACE ROGERS SPALDING, D.D.S., F.A.A.P., Birmingham, Mich.

THERE is no country in the world where the term "conservation" has had more common usage or where there is a greater need of its practice than in the United States. According to general acceptance, it has come to mean *wise use* of resources; hence, in considering its application to periodontia, a discussion of the means for the wise use of the periodontist's knowledge, time and skill is suggested.

The use of extreme measures accompanied by waste is inclined to stimulate agitation in any thoughtful person whom it may concern. In our calmer moods, we recognize the fallacy of radical methods except in emergencies, and ask not for war with its tragedies and devastation, nor for lessons in thrift through a crash in the stock market, but for arbitration, humanitarianism, education, temperance

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in all things, and for conservation of national and personal resources. Conservation does not imply hoarding as a miser hoards his gold, but use with wisdom and judgment, which, at the same time, may lead to an increase of the capital.

A thorough consideration of our subject must of necessity include dental caries, since its consequences, in the form of food impaction, shifting of teeth, improper use of teeth, faulty dental restorations and loss of teeth, are frequently found among the exciting and predisposing causes of periodontoclasia. The etiology, prevention and treatment of dental caries demand the attention of every periodontist.

There is no question that the number of successful periodontists is adequate for demonstration of treatment methods and cures of periodontoclasia, that there is enough uniformity in the fundamentals of successful periodontic practice and that the measure of success in combating dental and periodontal disease by the use of these methods is of sufficient magnitude to warrant acceptance and endorsement of periodontia by the dental profession. In spite of this fact, there is a tendency on the part of the dental profession generally, and of research workers particularly, to undervalue, question and even ignore accomplishments in prevention and treatment of periodontal disease and dental caries. A part of the explanation for this indifference toward the periodontists' contribution to the mouth health program and dental progress is, I believe, a lack of effort on the part of periodontists to convince a sufficient number of individual dentists of the opportunities for greater service that lie in periodontia, by means of practical demonstration. Certainly it is not a lack of cooperation with dental organizations which is at fault, since a large proportion of the Academy membership contribute to them generously of time and ability and in direct proportion to their opportunities. As an organization, the Academy has assumed a most helpful attitude toward the American Dental Association in assisting in the development of the Section on Periodontia to its present state of excellence. We are forced thus to conclude that it is the personal contacts of periodontists with other dentists which offer neglected opportunities for "casting bread upon the waters which will return after many days" and for hastening the full recognition of their art and science.

In a recent paper on "The Present Status of Preventive Dentistry," by a leading dental educator, the following statements were made which represent the attitude of dentists in general, and which are all too frequently expressed: "We have not available at present a body of facts sufficient to serve as a basis for an adequate program of preventive dentistry. Until this body of facts is available, we can only treat symptoms, and thus prevention in the sense that it is used in medicine is impossible. There are, it is true, some things which may be done which will influence favorably conditions in the mouth and will have some prophylactic effect. These things should be a part of the practice of every dentist."

Is this, all too common, evaluation of the present status of preventive dentistry to go unchallenged? The late D. D. Smith, thirty years ago, maintained that he was able to prevent by doing "some of the things which may be done," 90 per cent of new dental caries, and his followers are willing to verify his statement by their own experience. Periodontists have not been content to sit idly by awaiting the discovery of the ultimate cause of dental and periodontal disease, but have been recognizing and removing the obvious causes, while the research workers are

seeking the "subtle, invisible threads." They are well aware that the obvious causes may not be the real ones at all; nevertheless, by their removal, such satisfactory results are obtainable in terms of mouth health and preventive dentistry as to justify the existence of the periodontist and this Academy.

Some of the obvious factors in dental and periodontal lesions are food débris, bacteria, salivary and subgingival calculus, traumatism, faulty dental restorations, malformation of teeth, faulty relation of approximating occlusal surfaces, nonuse and misuse of teeth, crowding of teeth, missing and defective contacts, malposition of teeth, viscous coatings, malocclusion and dietary deficiences, such as an inadequate amount of essential food factors, or a lack of food material furnishing bulk and cleansing qualities, and offering some resistance to mastication. That there may be a deleterious influence exerted in the mouth by pathologic conditions in other parts of the body is accepted without question and is observed by those who treat diseases of the periodontium, but these cases are in the minority. Even in the majority of the latter involvements, control of the obvious causes usually reduces the local symptoms, while a lack of it frequently exaggerates them.

The cause of disease is seldom single, but is rather multiple, and is the result of impaired or perverted cell action, so commonly resulting from the chemical poisons of bacterial growth. Therefore, since dental operations are performed in a veritable hotbed of bacteria, it is not wisdom to underrate their destructive potentialities, and the inevitable part they play in those diseases which are the chief concern of dentistry. An army of forces bent on their destruction should be employed, and a border patrol established at the gingival margin.

As to the ultimate causes of dental caries and diseases of the periodontium, the tireless, self-sacrificing devotees of science will discover them eventually, and will evaluate the influence on dental caries and periodontoclasia of a deficiency of the essential food factors which are at present under suspicion, such as vitamins A, C and D, calcium, and phosphorus; the absence of a normal dental lymph, the presence of *Bacillus acidophilus,* and of sunshine; the disturbance of the glands of internal secretion, and the presence of an acidosis or an alkalosis. Until this is accomplished by science, dental clinicians must deal with the obvious causes of diseases in the oral cavity, and, in so doing, are making wise use of the knowledge at hand.

Since periodontists deal largely with the environment of the teeth, which cannot be dissociated from bacteriology, glandular secretions and their chemistry, bone absorption and regeneration, pathology of hard and soft structures, the function of the supporting tissues of the teeth and the relation of this part of the body to the whole, it is their obligation to educate themselves by becoming advanced students not only of dentistry but also of all related sciences. May not the connecting link between dentistry and medicine be the science of periodontology? While it is not essential that we barter our birthright of a special form of health service for another, it is requisite for the best interests of humanity that all dentists become students, observers and recorders. It is our lack of worthwhile records which makes our arguments appear weak to the scientifically minded.

As to the wise use of the periodontist's time, he can rarely spend a part of it more profitably than in the dental education of his patients. The more dental patients know about dentistry, the greater will be

their respect for dentists and dentistry, and the more willing they will be to cooperate. It is not only important that the dentist (to quote W. B. Dunning) "acquire the mental habit of seeing the body as a whole with his own field as a glorified section of it," but he must also encourage this thought in the minds of his patients. Remind him that the teeth, jaws and muscles of mastication are a vital part of the mechanism of digestion and that he cannot hope for complete digestion and assimilation if he omits the first two steps in the process: thorough mastication and insalivation. The vigorous use of the teeth and jaws in the mastication of resistant foods is the normal way to stimulate the circulation in the pulps of the teeth and the periodontal tissues.

Dental patients should be taught that the bacteria associated with the diseases of childhood, influenza, colds and other diseases of the respiratory tract find the mouth a congenial habitat, and that mouth health and hygiene, necessarily reduce the number of these bacteria in this locality and tend to discourage their growth. The oral hygiene demonstrations in the public schools of several cities, by their resultant reduction of the contagious diseases of childhood in these schools, lend strength to the foregoing statement. The dentist is the logical guardian of health in the mouth, and the periodontist, a mouth health specialist who, recognizing especially the value of mouth hygiene, will, if wise, transfer his appreciation of it to his patients.

The greatest single factor in the conservation of the periodontist's time is the cooperation of his patients in the home care of the mouth. It is the common experience of every dentist to be asked by patients for an appointment to have their teeth "cleaned." If these patients' teeth are not clean, their mouths are usually unhealthy. An environment of filth cannot be a healthful one, whether in the mouth or elsewhere in the body. Therefore, such mouths need care which should be dignified by the name treatment. It is not customary to ask physicians, whom so many dentists wish to emulate, to clean any part of the body. All their operations are dignified by an impressive name, and may we inquire why any operation which is intended to promote health in the mouth should have attached to it such a humiliating term? Until all dentists discontinue the use of the term "cleaning teeth," and transfer the responsibility of clean teeth not to the dental hygienist but to the patients themselves, we cannot hope for the recognition of dentistry as a profession of culture regardless of scientific attainments.

D. D. Smith insisted on thorough home care of the mouth and, on occasion, would send patients away who had failed to carry out instructions. It is not customary to go to a barber with an unclean face, nor to a manicurist with soiled hands, but it is customary for patients to go to a dentist with unclean teeth, and, not only that, he is asked to clean them. A person who does not value his teeth enough to keep them clean himself should have no claim on the limited time of a dentist for services. When this is the unanimous opinion of the dental profession, conservation of the periodontist's time will be a practicability for if mouths were kept actually as clean as well-trained patients can keep them and the teeth vigorously used on resistant, health promoting foods, our most serious problems in dentistry would solve themselves. A clean mouth is conducive to health in the oral cavity and the body, and it is our obligation to instruct patients in an effectual method of home care of the

mouth, and to expect them to carry out instructions.

Let us imagine a dental practice made up of patients enthusiastic about the health of their mouths and desirous of cooperating with the dentist to the end that their teeth might be preserved and the supporting tissues remain intact. The dentist's time and skill in such a practice would be unhampered, and he would be rendering a real health service to a greater number than is possible in the average dental practice of today, where the dentist only half-heartedly believes that a clean mouth prevents, in some measure, dental and periodontal disease and is frequently asked by his patients to "clean" their teeth. It is generally the last thing that he does and that under protest, with a lack of thoroughness that would not be tolerated in any other dental operation. This occasional "cleaning of the teeth," whether by the dentist or the dental hygienist, unaccompanied by effectual home care, is of so little value in the promotion of mouth health as to be disregarded, and yet many evaluations of a continuously clean mouth as a dental and periodontal health factor have been based upon observations of effects secured by half measures and not by such results as are readily demonstrable.

To allow to grow up in our midst an army of workers trained to do work that we were anxious to be rid of appears not to have been the wisest solution of a most serious problem. A well-trained patient whose mouth is in a state of health can do for himself all that the dental hygienist is allowed to do with the possible exception of removing salivary calculus, which, in a well kept mouth, is entirely absent or is kept down to a minimum; but it is the dentist's duty to see to it that his patients' mouths are healthy. It is the constant control of bacterial growth on the tooth and tongue surfaces and in the interproximal spaces, and the frequent disturbance of stasis, the systematic stimulation of the circulation in the pulps and supporting tissues, and good operative dentistry, that promote health in the mouth. In other words, it is the continual and thorough home care of the mouth, furthered by the counsel and cooperation of the dentist, with correct operative procedures, restorative and surgical, that is the inevitable solution for controlling those obvious causes of dental and periodontal disease.

Effective work on the part of the patient materially lessens the time required for dental operations and the number of prophylactic treatments for each patient, and to aspire to a type of practice which expects this cooperation should be the aim of every dentist regardless of discoveries which may be forthcoming in preventive dentistry. A clean mouth will always be a social asset and health requirement.

As to the wise use of the periodontist's skill, we venture to state that the greater his skill, the greater his appreciation of the possibilities of conservative treatment will be, and the less often will he feel the need of radical surgical procedures. Extreme conditions sometimes call for extreme measures, but extreme conditions are more often found in institutional clinics than in private practice. It is said that the tendency of disease is toward recovery, and when we work with Nature, instead of against her, we are frequently astonished at her accomplishments. Since the sense of touch can be developed almost indefinitely, there are infinite possibilities in the conservative treatment of periodontoclasia, and a wise use of the periodontist's skill suggests constructive measures rather than unnecessarily destructive ones. The finer his technic and skill, the greater his satisfaction in accomplishing

the seemingly impossible, which, for him, would be quite within the range of possibilities. The conservation of even a small amount of supporting tissue would be his desire, and to destroy without cause any part of it that might be retained in a state of health would seem to him unjustifiable.

CONCLUSION

I wish to emphasize that the wise use of the periodontist's knowledge would suggest its increase by continual study of the sciences related to periodontia, a continuance of active participation in and contribution to dental society programs and a generous sharing of his enthusiasm, vision and special knowledge with his fellow dentists. The conservation of his time can best be brought about by instructing his patients in a general way concerning dentistry and the relation of the mouth and its health to the health of the body, and, in a specific way, by giving them detailed information concerning our present knowledge of conditions which promote mouth health and preserve the teeth and periodontal structures, and by teaching them an effectual method of home care of the mouth, with particular emphasis on the fact that it is *their* responsibility to keep their own teeth clean. And, finally, the greater the skill of the periodontist, the wiser he is apt to be in its application. "The most satisfactory method" of treating periodontoclasia, as stated by Arthur H. Merritt, "must always be the one in which we can get the best results with the least amount of mutilation."

This is an epoch when dentistry worships at the shrine of science, and rightly so, if in moderation, but not if to such an extent as to dull our perspective of the true value of clinical dentistry and the part it plays in health service. Mr. Notch in "King Mob" says, "This is an age when great spirits die, done to death by a formula." It is also an age when great opportunities for service die, done to death by a formula. Let us not permit the possibilities of periodontia to die while we wait for a formula.

DISCUSSION

Harold J. Leonard, New York City: Dr. Spalding has brought out the valuable material which we have at the present time in preventive dentistry and has felt a little hurt because some of the articles, of which mine was one, contained the statement that we did not at the present time have such a type of preventive program or preventive material as would make it possible for us to speak of prevention in the same sense that they speak of prevention in many diseases in medicine. The article from which she quoted and the statement which she quoted were meant to make something of an effect and perhaps were something of an overstatement, but it seems to me that it is time that dentists quit talking about preventive dentistry and its practice as though, if we desired to, we could absolutely eliminate dental disease from the mouths of our patients. We have not reached that point yet, and it will evidently be some few years before we do. The article which she quoted intended to make it clear that, as yet, we had not arrived at that dental millennium when we could, by proper physiologic means, prevent dental disease. That is not saying that we cannot, to a very large extent, prevent it by symptomatic treatment. Dr. Spalding has shown us how we can do it very ably.

Celia Rich, Nashville, Tenn.: I wish to ask some of those who think differently about conservative periodontal surgery to say something about it. Many of our members do more and more gum resection, and I thought that it would be well to have a discussion of that subject at this time.

A. C. Hamm, Denver, Colo.: I should like to ask Dr. Spalding if she practices gum resection in the case of deep pyorrhea pockets.

Dr. Spalding: No.

Dr. Hamm: Do I understand, Dr. Spalding, that under no circumstances, do you operate on the gum tissue? If not, what means or what methods do you use to control the condition permanently, outside of curettage and massage.

Dr. Spalding: The cause of my failures in the past has been a lack of judgment in coordinating diagnosis and prognosis, when I have not recognized the fact that it was impossible to save hopelessly involved teeth by any means, radical surgical procedures or conservative measures. When diagnosis or prognosis were faulty, I have had a recurrence of conditions. But I feel certain that, by conservative means, I am able to eliminate the pockets as successfully as you are by radical surgical methods. It is entirely a question of judgment in the first place and skill in the second place. There are some teeth that should not be retained in the mouth; there is no question about that. When I began to practice about twenty-six years ago, in my enthusiasm, I was positive that I could save any tooth in anyone's mouth under any conditions, and consequently I made some very bad decisions at that time. But I feel that I have acquired better judgment. I use methods similar to those advocated by Dr. James for the elimination of the periodontal pocket, curettage, massage and stimulation. I think that we all have our individual methods of treatment as far as technic is concerned. My objective is, as it is yours, to eliminate the pockets, and to conserve all tissue that I possibly can in a state of health. This can be done by conservative methods. The more enthusiastic you are about conservative treatment and the more you practice it, the more skilful you become.

Arthur H. Merritt: I am one of those who believe that the man who does all his work by surgical measures is just as far wrong as the man who may do all of them by the more conservative methods of treatment. I believe that each has its place in the practice of periodontia, and the wise clinician is he who knows, of his experience having learned, which of the two methods is applicable to the case in hand. I also believe, out of an experience longer than Dr. Spalding's, that the more skilful the periodontist becomes, the less often he will have to resort to radical measures. That there are cases in which it is necessary, there can be no doubt, but that those cases are as frequent as some of our colleagues seem to believe, I am very much in doubt. So I would say, from my own experience and from the experience of contact with many men doing this work throughout the United States and Canada, that the wise clinician is always that individual who, studying his cases carefully, and making his correct diagnoses, leans toward conservative measures, applying the surgical only in those cases in which conservative methods may not succeed.

Dr. Spalding (closing): I have no criticism to make of those who are practicing radical surgery for the treatment of periodontoclasia. I am simply stating that while conservation is constructive, radical measures are destructive in their tendency, and, therefore, it appears wise to give the former method primary consideration and application. I feel that there are instances and exceptional cases where there is no question that radical measures are called for and advisably practiced.

AN ANALYSIS OF TOOTH COLOR

By E. BRUCE CLARK, D.D.S., Uniontown, Pa.

A COLOR measurement or analysis is made to provide a numerical record of the color analyzed. The analysis may be made by two distinct methods. One method specifies the measurements in terms of the color stimulus, that is, in terms of the radiant energy or light reflected from the surface of opaque objects and transmitted by transparent objects. The other method specifies the measurement in terms of the three attributes or dimensions of color. The choice of method depends on the purpose for which the measurements are to be used. Both methods provide a numerical specification of color that can be recorded.

Jour. A. D. A., November, 1931

The purpose of this report is to present summarized data accumulated in an analysis of the teeth of 1,000 patients who over a period of eight years came to my office for treatment. The purpose in making this analysis was to establish and record definite specifications of tooth color, thus providing records that can be used as a basis for further research in color and its application in the field of dentistry.

The choice of method for making a color analysis is almost as important as the measurements themselves, because certain types of measurements are helpful only in securing certain results. The measurement secured by the first of the two general methods of analysis is known as the "spectral reflectance" of a color. This measurement determines the spectral character or distribution of the color together with its reflecting power at each wave length of the spectrum. Such measurements are recorded in terms of the color stimulus and are quantitative measurements of the radiant energy reflected or transmitted by the color.[1] Radiant energy measurements and color measurements are vastly different, because energy is a physical phenomenon and color is a psychologic sensation.[2] Although a sensation cannot be accurately described by a specification of its physical stimulus,[3] energy measurements are of value in determining a great many characteristics of color that cannot be seen, because of the fact that the eye is not capable of analyzing a color spectrally. These measurements are of particular value in determining the behavior of colors under different sources of illumination, since two colors that match perfectly in daylight will not match under artificial light unless their spectral characteristics are identical.

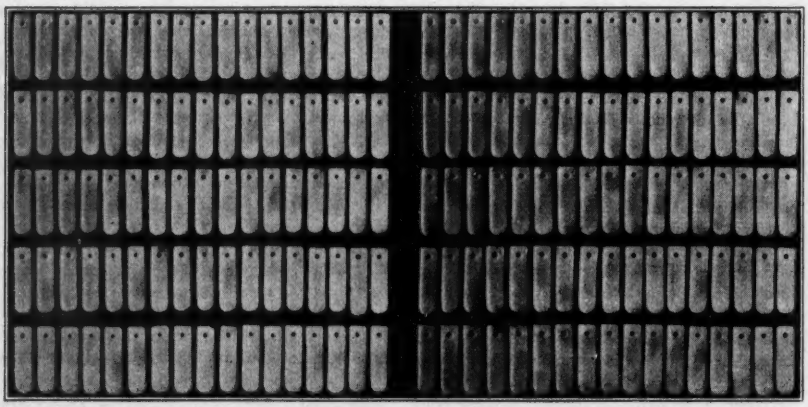

Fig. 1.—Ordinal arrangement of one hue of tooth color in equal steps of brilliance and saturation. This is an arrangement of one of five hues of a system primarily constructed for the determination of the limits of tooth color in its various dimensions.

1. McNicholas, H. J.: Spectral Transmission and Reflection Measurements, Bur. Standards J. Res., Paper No. 30, November, 1928.

2. Troland, L. T.: Psychology of Color in Relation to Illumination, Tr. Illum. Eng. Soc., 13:21, 1918.

3. Parsons, J. H.: Introduction to Study of Color Vision, Cambridge, England, 1915.

The other method of color analysis differs from the spectral method in that it measures the color sensation instead of the color stimulus. These measurements are recorded in terms of the three attributes or dimensions of color and they describe the color as it is seen by the eye. From a glance at these measurements, we can determine whether the color is red, yellow, green, etc., and whether it is dark or light and weak or strong. In other words, the color is measured in terms of hue, brilliance and saturation, and the appearance of a color can be described only by reference to these three attributes.[4]

In dentistry, we are required to match the natural tooth structure in appearance by either the selection or the construction of artificial teeth. To secure favorable resorative results, it is necessary that the materials used exhibit color characteristics similar to those found in the teeth. Any brief analysis of the materials available today will reveal their color deficiencies. The combined products of all manufacturers do not exhibit a sufficiently wide range of color to meet the requirements of the natural teeth in two of the three dimensions of color. For this reason, the analysis here reported has been made in terms of color[5] and not in terms of its stimuli, and thus standards are established for further research in the de-

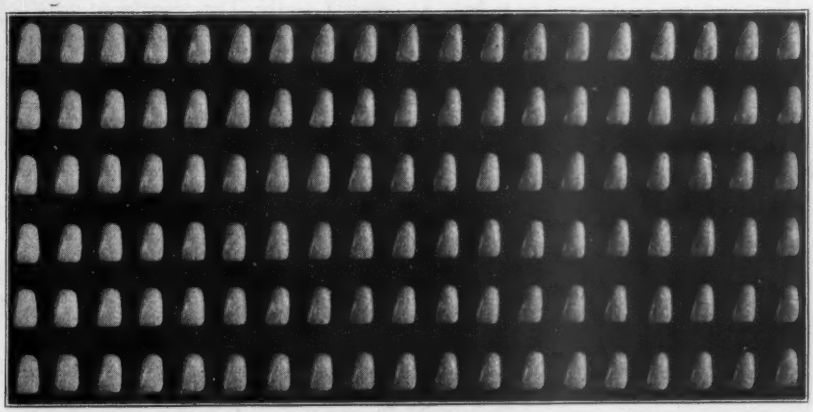

Fig. 2.—Ordinal arrangement of one hue of tooth color in shade-guide teeth. Three hues in this arrangement were necessary to cover the field of tooth color.

4. Troland, L. T.: Report of Committee on Colorimetry, J. Optical Soc. America, 6:534, 1922.

5. By the selection of the latter method, it is not to be inferred that spectral measurements are of no value in dentistry. On the contrary, they are of exceptional value for certain requirements, such as, for example, the development of a nonsilicate ceramic cement that will not influence and change the apparent color of the tooth under varying illuminating conditions. It is quite possible to make one material match another material in spectral character, since both materials derive their color from pigments. It is difficult to estimate the chemical and physical possibilities of developing dental restorative materials that will exactly match natural tooth structure in its spectral distribution.

velopment of the pigments necessary to cover the entire field of tooth color.

When the type of measurements needed has been determined, it becomes necessary to find a method for securing these measurements. The natural teeth in their environment of red mucous membrane present a color condition that it is difficult to measure, because color analyzers and instruments are not easily adapted to these unusual conditions. This difficulty has been partially overcome by the use of a lens that can be focused to include a very small portion of a tooth surface. This lens may be adapted to almost every type of instrument, but its use has a distinct disadvantage in that it excludes certain environmental influences which are contributory to tooth color.

The environment contributes to the color of a tooth in two ways: first, by simultaneous contrast with surrounding colors, and, secondly, by what we may call direct environmental influence. The contrasting gum tissue, lips and complexion of the individual have a general color influence on the teeth, while, at the same time, the color of a certain area may affect the color of another area of the same tooth by contrast. The direct influence is caused by a change in the quality of the illuminating light as it enters the tooth. A certain portion of this light enters the tooth by way of the approximating teeth and gum tissues, which change the quality of the light to a very marked degree. The presence of metallic fillings obstructs this general transmission of light, and the resulting influence on color is obvious.

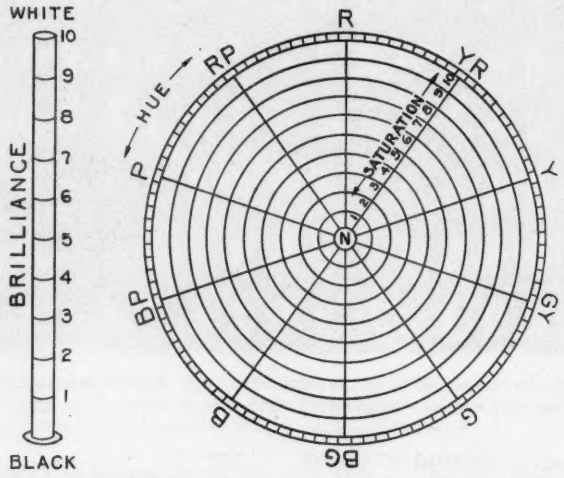

Fig. 3.—Munsell color notation in terms of both ten and 100 steps each of hue, brilliance and saturation.

The use of a lens does not nullify this direct influence provided the tooth and color standards are illuminated in the proper manner with light of the same quality and intensity. The influence of simultaneous contrast, on the other hand, cannot be retained when light from a certain area of the tooth is directed by a

lens into a photometric field for comparison. Therefore, measurements made in this manner must necessarily contain an error which cannot be corrected, for it is quite impossible to make measurements of all the influencing conditions.

It is, of course, a well-known fact that the teeth can be matched in their natural environment by use of a shade-guide tooth, provided the shade-guide tooth is of correct color composition and can be placed in an edentulous space in normal alinement with the remaining teeth. In this position, the shade-guide tooth is subject to the same environmental influence as the natural tooth, but when all the teeth are present in the mouth, this ideal condition cannot be secured.

All these factors were carefully considered before a final method was adopted for securing the measurements. Since ideal conditions for the shade-guide method are not uncommon, it was chosen, regardless of the fact that three years' preliminary work was necessary to arrange the colors in a system that could be adapted to this method. To be able to fully comprehend the possibilities of such a system, it is necessary that the attributes of color be clearly understood. The following definitions may be helpful to any reader not thoroughly familiar with color terminology[6]:

"Color" is the general name for all sensations arising from the activity of the retina of the eye and its attached nervous mechanism, this activity being, in nearly every case, in the normal individual, a specific response to radiant energy of certain wave lengths and intensity. It may be exemplified by an enumeration of characteristic instances, such as red, yellow, blue, black, white, gray and pink.

The "attributes" of color are those qualities often referred to as dimensions of color. They are briefly described in the three definitions following:

"Brilliance" is that attribute of any color in respect of which it may be classed as equivalent to some member of the series of grays ranging between black and white. Brilliance is the most important attribute in the study of tooth color, since

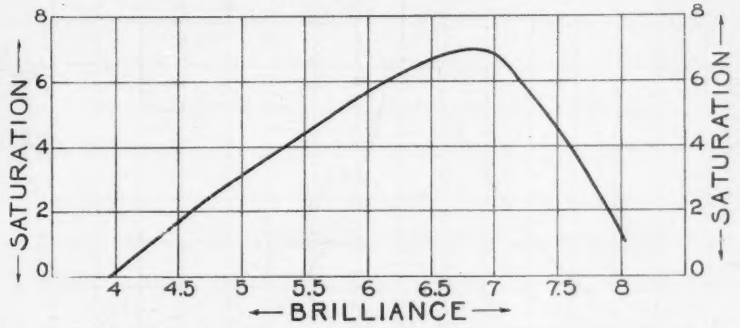

Fig. 4.—Brilliance of tooth color plotted against saturation. The curve is representative of all teeth regardless of hue.

6. The definitions and color terms used in this report are those recommended by the Committee on Colorimetry of the Optical Society of America. The definitions and nomenclature recommendations appear in the journal of that society (6:531, 1922).

it is that quality which we speak of as "light" or "dark." Its range is from the blackest black through the neutral grays to the most brilliant white.

"Hue" is that attribute of certain colors in respect of which they differ characteristically from the gray of the same brilliance and which permits them to be classed as reddish, yellowish, greenish or bluish.

"Saturation" is that attribute of all colors possessing a hue which determines their degree of difference from a gray of the same brilliance.

"chromatic" and "acromatic" species, respectively, accordingly as they do or do not exhibit hue. The former may be designated briefly as chromas (including colors of all finite degrees of saturation), and the latter as grays (including black and white). "Median gray" is the middle member of a series of grays in which each member differs from its immediate neighbors by the least perceptible difference, and of which black and white are the terminal members. This gray furnishes the most practical reference point for the acromatic as well as for the chromatic

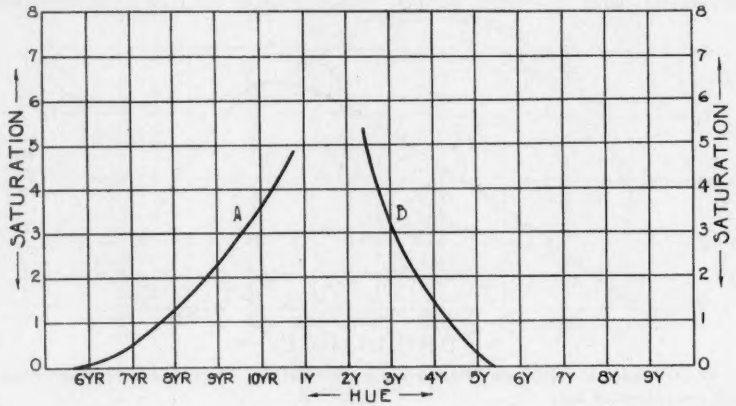

Fig. 5.—Hue range of dark teeth having an average brilliance of 5.64 plotted against saturation. Curve "A" defines the reddish yellow boundary, and curve "B," the greenish yellow boundary.

The term "chromaticity" may be used to characterize a color qualitatively without reference to its brilliance. Chromaticity is determined by hue and saturation together, a gray being specified by the statement that it has no chromaticity. All colors except absolute black exhibit brilliance, but grays have zero saturation, and hence no hue. All colors which exhibit a hue must also exhibit saturation, and vice versa. Colors may be classified into series of colors. "Tints" and "shades" are colors, including grays and chromas which are, respectively, lighter or darker than medium gray.

Methods of color analysis which provide measurements in terms of the attributes of color are based on the following law: The three attributes of color can be treated as quantities and specified numerically, if all discriminable colors are conceived to be arranged in a system such

that neighboring members differ from one another in each of the three attributes in just noticeable degrees.[7] Tooth color can therefore be measured and defined if all colors found in the teeth are arranged in a system providing the foregoing requirements. The preliminary work previously referred to consisted of arranging tooth color in just such a system as the foregoing law requires.

Since the limits or extent of tooth color in any one of its attributes or dimensions had never been recorded, it was necessary to have the constructed system exceed the limits of tooth color so that they could be definitely established. An approximate extent of these limits was first established from an analysis of several hundred accumulated samples of porcelain that had been constructed from materials that were known to have matched, or approximately matched, natural tooth structure by their application in ceramic restorations. These samples served as a starting point. From them, a yellow and a red hue limit were selected and each hue was arranged in ordinal steps of brilliance and saturation, as illustrated in Figure 1. The labor necessitated in the arrangement of a hue in the graduated scales of brilliance and saturation presented a great many difficulties that could be eliminated only by time and experience. The greatest labor-saving factor was derived by deviating slightly from the rule of just noticeable degrees and establishing brilliance scales that differed from one another in varying degrees of saturation, the perceptibility of which decreased as the brilliance increased. This provided the establishment of brilliance scales by a dilution of dark saturated and unsaturated colors with plain porcelain material following an established logarithmic scale. The plan necessitated the construction of many more samples of porcelain than were necessary for an ideal system; but it eliminated the tremendous labor that would have been entailed by constructing each

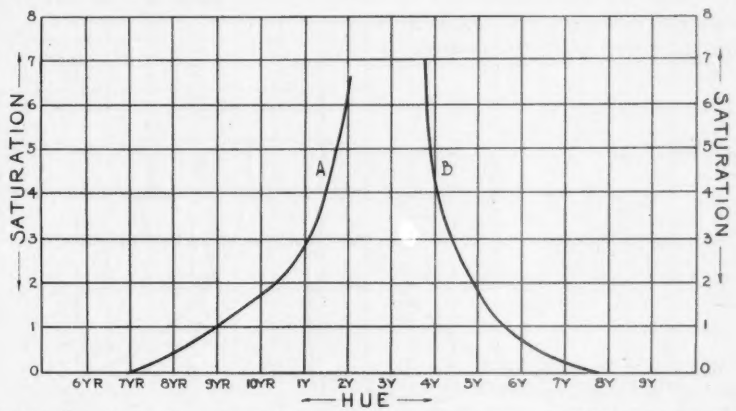

Fig. 6.—Hue range of medium brilliant teeth having an average brilliance of 6.53 plotted against saturation.

7. Troland, L. T.: Footnote 6, 536. Brown, W.: Essentials of Mental Measurement, Cambridge, England, 1911. Titchner, E. B.: Textbook of Psychology, New York, 1909.

unit to match an established standard. The Munsell color standards[8] and the Jones hue scale[9] were indispensable in this work.

The actual matching of the natural teeth began with the completion of the ordinal arrangement of the two hues. Only the anterior teeth, including the cuspids, were matched. All teeth exhibiting pathologic processes, such as white areas of decalcification and brown stain, together with those presenting metallic stains, were disregarded. The natural staining or darkening of the teeth that appears with advancing age was considered normal and included in the records. The color of devitalized teeth was recorded, except when it had apparently been influenced by root-canal filling material and medicinal stain.

Soon after the matching process began, it was found that one hue was deficient in its extent and that the other one had overextended the hue limits in certain degrees of saturation. It was also noted that the hue limits varied widely with the degree of saturation. These findings finally required the construction of three additional hues before all tooth colors could be matched. The reddish yellows found in the body colors of the teeth of younger people presented the greatest difficulty in the hue field. As it was impossible to duplicate these colors in high fusing porcelain because of the scarcity of pigments that will withstand high heat, it became necessary to resort to low fusing materials and china paints.

The brilliance limits of tooth color were comparatively easy to establish, but the saturation presented even greater difficulties than the hue limits. The bluish gray areas found in the incisal areas of thin incisors could not be matched with the materials available, since they were too saturated, which made it necessary to use stains instead. These stains were placed on a neutral white background to avoid any influence from a hue that might

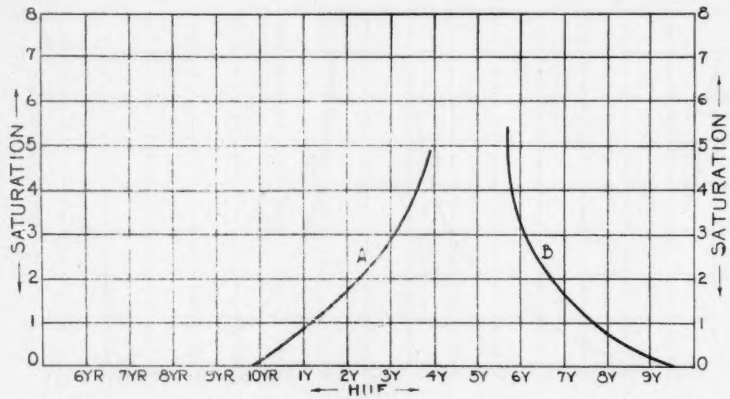

Fig. 7.—Hue range of light teeth having an average brilliance of 7.12 plotted against saturation.

8. Munsell, A. H.: Munsell Book of Color, Standard Ed., Baltimore, Md., 1929.

9. Jones, L. A.: Fundamental Scale of Pure Hue and Retinal Sensibility to Hue Differences, Communication No. 44, Research Lab. Eastman Kodak Co., Rochester, N. Y.

be present in the background material. On analysis, these areas were found to be neutral in color and their appearance of bluish gray due entirely to simultaneous contrast[10] with the saturated yellows of the other portions of the tooth. To establish the maximum limit of saturation, especially in the lighter colors, it was necessary to produce a pure white plain porcelain, since the grayness of ordinary plain porcelain has a decided influence on the saturation of the color developed in it.

The completed system furnished a quick and fairly accurate method for the

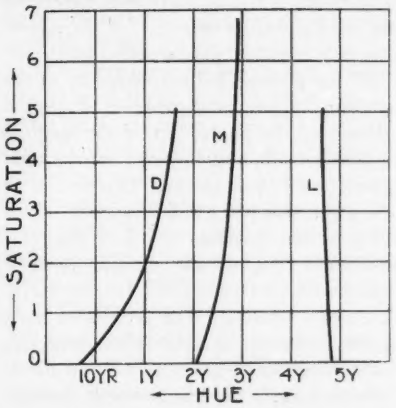

Fig. 8.—Curves plotting average hue of three groups of teeth against saturation. The dark group (*D*) has an average brilliance of 5.64, the medium brilliant group (*M*), of 6.53, and the light group (*L*), of 7.12.

measurement of tooth color. The size and form of the porcelain samples used produced an error, but since the proportions of the materials used in the construction of each unit were carefully recorded in centigrams, it was an easy matter to determine the error and correct it for the construction of shade-guide teeth. It will be remembered that the system was originally designed to determine the limits of tooth color so that these limits could be used for the arrangement of shade-guide teeth into a similar system (Fig. 2). The original system not only determined these limits, but it also established data relative to the average occurrence of certain color characteristics throughout the entire field of tooth color. These data were later verified and changed where changes were necessary by use of the shade-guide teeth.

The specifications of tooth color determined in this manner can be stated in terms of any color system desired, since

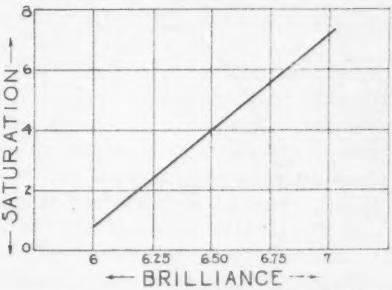

Fig. 9.—Average relation in same tooth of brilliance to saturation, distribution of which is illustrated in Figure 10.

the colors have not only been recorded but also established in fused porcelain standards. Readings taken from these porcelain standards have been plotted diagrammatically in the several charts illustrated in Figures 4-10. They have been plotted in terms of the Munsell Color System,[11] which appears to be the most popular and most comprehensive system available. Figure 3 diagrammatically illustrates the Munsell three dimensional sys-

10. Luckiesh, M.: Color and Its Application, New York, 1927.

11. Munsell, A. H.: A Color Notation, Baltimore, Md., 1926.

tem of color notation. In the hue scale, each of the five basic hues, red, yellow, green, blue, and purple, as well as the five intermediate hues, yellow-red, green-yellow, blue-green, blue-purple and purple-red, are divided into ten equal steps, which makes a total division of 100 parts. The steps in each hue are numbered from one to ten inclusive. The brilliance scale is divided into ten equal steps and numbered from one to ten, black being represented by zero and white by ten. Each of these steps may be subdivided into ten additional steps, which are written as tenths. The saturation scale is similar to the brilliance scale in notation, zero designating neutral gray

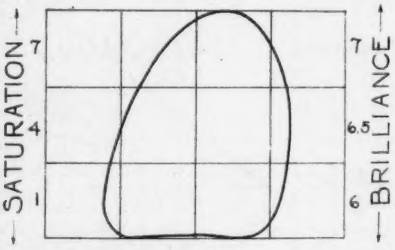

Fig. 10.—Relation of saturation to brilliance and typical distribution throughout crown of tooth.

and ten a fairly strong degree of saturation. The system develops standards that are as high as fourteen in saturation. A typical example of the Munsell color notation is written thus: 4Y7/9, 4Y designating the hue; 7, the brilliance, and 9, the saturation.

The extent of brilliance over the entire field of tooth color is illustrated by the curve in Figure 4, which is plotted against saturation. The darkest colors are exhibited by the neutral areas occurring in teeth presenting thin translucent incisal areas. The lightest colors are found fairly well distributed over the surfaces of the light opaque teeth. The most saturated gingival third areas vary only slightly in brilliance, as illustrated by the peak of the curve.

To plot the distribution of hue together with brilliance and saturation, it has been found advantageous to divide the field of tooth color into three classifications, namely, dark teeth, medium brilliant teeth and light teeth, presenting average brilliancies of 5.64, 6.53 and 7.12, respectively. The brilliance of the middle third of a tooth may be considered the average brilliance of that tooth (Figs. 9-10). The hue extent of the dark group is illustrated by the curves of Figure 5, "A" representing the reddest yellow boundary, and "B" the greenest yellow boundary of the group. In the same manner, Figure 6 illustrates the hue extent of the medium brilliant teeth, and Figure 7, of the light group. The average hue distribution of each group is plotted in Figure 8, which clearly demonstrates the fact that the dominant hue of the natural teeth is yellow and not yellow-red (orange) as is generally believed. The yellows of tooth color, however, lie so near the boundary of orange that it has been difficult in the past to specify the hue correctly without definite measurements. In Figure 5, it will be seen that colors of low saturation extend well into yellow-red, but when we consider the power of these low saturations, we find that they have comparatively little influence on the dominant hue of the tooth. For example, let us select a tooth that has a gingival color of 1Y6/4 and an incisal color of 7YR5/1. The power number is secured by multiplying the brilliance by the saturation. In this case, the gingival color would have a power of 24 and the incisal color a power of 5; therefore, the incisal hue contributes only a little more than one-fifth to the

dominant hue of the tooth, when the areas are equal, and the gingival color contributes almost four-fifths, thus making the dominant hue lie in the yellow, slightly over the boundary of yellow-red.

The average relation of saturation to brilliance in the colors appearing in the same tooth is illustrated in Figure 9. The differences are almost always in direct ratio to each other, as both increase proportionately from the incisal edge toward the gum line (Fig. 10). The distribution of hue throughout the crown of a tooth does not follow any specific rule except that extreme hue differences are not often seen in the same tooth. The relation between the colors of different teeth in the same mouth has not been plotted because the difference between central and lateral incisors is so slight that it will require a great many additional data to secure accurate charts of specification. The cuspids almost always present the same hue in a stronger degree of saturation for all areas, with darker gingival areas and equal or lighter incisal areas than exhibited by the central and lateral incisors in the same denture.

A most interesting phenomenon was recognized in the transfer of the original system to the system made of shade-guide teeth. It was discovered that a tooth exhibiting a strong gingival color together with a weak incisal color could not be matched by a shade-guide tooth made from the two materials that separately matched the gingival and incisal colors. When this method was attempted, the blend color produced in the middle third of the porcelain tooth did not match the middle third of the natural tooth in color. When the two original colors were mixed in equal proportions on a color wheel and a color was established in porcelain to match the result, the new porcelain color reproduced the middle third color of the natural tooth. These findings prove that the middle third color of a natural tooth is the result of a mixture of the gingival and incisal colors by the addative method, while the blend color of a porcelain tooth is necessarily secured by the subtractive mixture when only two colors are used.[12] The effect of this phenomenon was overcome by arranging the gingival colors on the shade-guide teeth in combination with incisal colors of only a slight saturation difference, similar to the difference found between the middle third and incisal third of a natural tooth. In matching the natural teeth, the various areas of the teeth were matched separately and the results recorded.

To transfer these records into terms of the Munsell color system, it was only necessary to make readings of the materials used in the particular shade-guide teeth that established the limits and averages of tooth color in the several dimensions. The materials were molded into samples having a uniform thickness of 2.5 mm., each presenting a flat surface of sufficient area to facilitate their calibration without the use of optical instruments. The readings were made in a dark room by two observers, each making three readings for each sample on three consecutive days. The average of these readings was then computed and accepted as final. The source of illumination was provided by two Macbeth daylight lamps furnished with filters calibrated to produce a light temperature of 5,900 K.

12. For a comparative description of the addative and subtractive methods of color mixture, see Luckiesh, M.: Footnote 12, p. 54.

INSURANCE, STATE AND PANEL SYSTEMS FOR MEDICAL AND DENTAL CARE AS NOW IN EXISTENCE*

By A. M. SIMONS, Chicago, Ill.

IF anybody says anything — no matter what — about health insurance, the proper reply is "Where?" and "When?" Almost any statement will be true of some time and place, and, equally, false for some other date and location. About as safe a generalization as could be made is that whatever insurance brought to the physicians yesterday will be delivered to the dentists today or tomorrow. That is why so much will be said about physicians in this discussion.

Insurance in Germany, Austria and Hungary is very different from that found in Denmark, Sweden, Great Britain, France or Belgium. German insurance of the nineties hardly knows itself in the entirely new dress furnished by presidential decree, July 26, 1930. Lloyd George installed a system in 1911, and it has been changed several times since. As far as the dentists are concerned, it made a new start in 1930.

We cannot even tell how much insurance there is in the world, or in how many nations it exists, because the definition is constantly changing. There is some health insurance in practically every country. There is much of it in the United States, Canada and other countries not usually listed as having systems of health insurance.

The International Labor Office of the League of Nations, which has investigated and written much on the subject, tries to divide the systems into "voluntary" and "compulsory." It does not put the United States in either list, but that may be because the United States is not a member of the League. Others refer to this country as having a "voluntary" system, because our fraternal organizations, commercial companies, trade unions, etc., do not have the power to compel membership. But our workmen's compensation acts are, within their scope, as thoroughly compulsory in their insurance features as anything Germany can show.

The Danish system, always first to be cited by opponents of compulsion as an example of successful "voluntary" insurance, has many compulsory features. True, the law does not say that every worker must join an insurance society, but if he does not, he has hard work getting a job, and if he does get sick and ask for help, he is deprived of nearly all his civic rights. The Danish government contributes more to these voluntary societies than Germany or Britain do to their compulsory ones. Moreover, practically every compulsory feature of any system started as a "voluntary" one, and it looks as though nearly all the voluntary features were rushing to become compulsory. Denmark, incidentally, has a compulsory scheme under consideration.

*Read before the Section on Dental Economics at the Midwinter Clinic of the Chicago Dental Society, Feb. 3, 1931.

All of which is intended to convey the idea that sickness insurance is a very live and growing thing that keeps changing all its features. It does not change by chance. Lines of evolution are common to nearly all the systems:

1. Insurance is constantly extending its scope to new countries, new classes and new benefits.

2. Its voluntary features tend to become compulsory.

3. The medical professions are having more and more to say about running the systems.

4. New branches of the healing art are included and treated the same as their predecessors.

5. Insurance societies are losing their influence.

6. Medical service of all kinds is being separated from cash benefits.

It would be almost safe to add a seventh tendency and say that, in every system, dentistry is growing more rapidly than any other form of service.

Recognizing the elusive character of the thing that we are trying to classify, we take the following list from the report on "Medical Education and Related Problems in Europe," by the Commission on Medical Education:

Countries having compulsory insurance: Austria, Bulgaria, Czechoslovakia, France (Alsace-Lorraine), Great Britain, Hungary, Italy (New Provinces), Latvia, Luxemburg, Poland, Roumania, Yugoslavia, Belgium, Chile, Esthonia, Germany, Greece, Irish Free State, Japan, Lithuania, Norway, Portugal, Russia and Switzerland.

Countries having voluntary insurance: Argentina, Belgium, Denmark, France (Comp. 1930), Northern Ireland, Netherlands, Palestine, Sweden, Union of South America, Australia, Canada, Finland, Great Britain, Italy, New Zealand, Spain, Switzerland and Uruguay.

Although it will be noted that those who prepared this list put some countries in both lists, and it was published in April, 1930, the following changes have already made it hopelessly out of date: Northern Ireland has come under the British compulsory system. The Netherlands adopted a compulsory system, March 1; France, Oct. 1, 1930. A government proposal in Sweden to improve the present voluntary system was rejected and the cabinet ordered to bring in a plan for a compulsory scheme. Australia omitted health insurance from a national scheme because a royal commission recommended that health be treated separately. Belgium's legislature has a complete revision and extension of her system under consideration. The Dominion of Canada has said that the central government will help any province installing a scheme. A royal commission in British Columbia has recommended compulsory health insurance and Quebec is studying a similar scheme. Another royal commission in South Africa is investigating the same subject.

The movement advances with accelerating speed. It went slowly after Germany's first installation, in 1883, to the end of the nineteenth century. Since then, and especially since the war, it has moved faster every year.

This is due in part to the work of the International Labor Office. The Tenth International Labor Conference, Geneva, 1927, composed of delegates from all members of the League, devoted its entire time to sickness insurance. The delegates came to this discussion with a report, filling several volumes, of the results of a world-wide investigation. A "draft convention" was submitted, binding every member nation to install a

system of compulsory health insurance as soon as possible. The vote on this agreement, as applying to industry and commerce, was adopted by a vote of 97 to 9, and as to agriculture, by a vote of 85 to 9. The vote was then made unanimous with some employers' delegates refraining from voting. Here are some of the significant sections of this agreement:

> Art. 1. Each member of the International Labor Organization which ratifies this Convention undertakes to set up a system of compulsory sickness insurance which shall be based on provisions at least equivalent to those contained in this Convention.
>
> Art. 2. The compulsory sickness insurance system shall apply to manual and nonmanual workers, including apprentices, employed in industrial undertakings and commercial undertakings, out workers and domestic servants.
>
> Art. 3. An insured person who is rendered incapable of work by reason of the abnormal state of his body or mental health shall be entitled to a cash benefit for at least the first twenty-six weeks of incapacity, from and including the first day for which the benefit is payable.[1]

The section on medical care reads as follows:

> Treatment by a fully qualified doctor and the supply of proper and sufficient medicines and appliances should be granted to an insured person from the beginning of his illness, and for so long as the state of his health requires it the insured person should be entitled to these benefits free of charge from the beginning of his illness and at least until the expiry of the period prescribed for the grant of the sickness benefit.[2]

The International Medical Association is composed of the officials of all the great national medical associations. It may be supposed to express, as nearly as any one body can express it, the consensus of medical opinion throughout the world. The general council of this organization has adopted a series of resolutions outlining the policies that it desires should be pursued in the administration of sickness insurance.[3] The introduction to these resolutions declares that

> The Association fully approves of the principle of sickness insurance for the poorer classes of the community. This principle represents a great social advance and a powerful factor in the prosperity and welfare of nations.

This Association held a meeting in Paris in October, 1930, and decided "that the inquiries of the Association for 1931 shall deal with the following two questions: 'Health insurance in 1931 in the various countries; the organization of the crusade against venereal diseases in the various countries'."[4]

It is almost inconceivable that America should escape the scope of a movement that has attained such momentum and maintained it for so long. There is no way to quarantine against such a movement, no vaccine that gives immunity.

It is significant that no country that has ever entered on the road of insurance has ever taken a backward step. No extension has ever been withdrawn. Each new country adopts it only after a study of its effects in other nations.

All recent systems of insurance have included dentistry from the beginning. All future ones will surely include it. Nearly all the old systems have already given it an important place, usually at first as an "optional" benefit. Then, as the demand grew, it was made statutory. Consequently, dentists can no longer depend on physicians to break the road alone and to suffer by themselves the evils of mistakes in organization and administration. Henceforth, these two

1. Official Bull. International Labor Conference, July 31, 1927 (Supp. Vol. 12, No. 3, p. 126).

2. Internat. Labor Rev., Aug. 7, 1927, pp. 153-6.

3. Indust. & Labor Information, Jan. 27, 1929, pp. 111-4.

4. J.A.M.A., 95:1925 (Dec. 20) 1930.

branches of the medical profession must move together in what concerns insurance; otherwise, they will suffer separately, and much more than if united.

What will the installation of an insurance system do to dentists? What has it done to them in other countries? What has it done to physicians which predicts the future of dentistry? What can dentists do to make its effects more favorable or, if they so desire, to delay or, possibly, forestall its coming? There are certainly few questions of more importance to the dental profession than these.

We know that insurance always has and always will profoundly change all the professions concerned with the care of health. Wherever it has been introduced, it has greatly changed the income, both as to amount and manner of receiving, methods of diagnosis and treatment, office practice, clinics and professional organizations and all the relations of individual dentists to all these things.

It has already changed them for dentists in most of the countries of the world. According to the International Labor Office, dentistry is a legal part of insurance systems in the following countries: Austria, Bulgaria, France, Germany, Great Britain, Hungary, Lithuania, Norway, Portugal, Russia, the Serb-Croat-Slovene Kingdom and Japan.

It is probable that a little closer and later examination would more than double this list. It is certain that, in most of the others, there is some sort of arrangement by which dental treatment is given and which will soon draw the dentists completely within the scheme.

Just how are the dentist and the physician affected? We can get a hundred answers and everyone backed up by proof from some system at some time and disproved by some other illustration. That is why it is important to know which way this movement is going, so that you can tell which answers are going to be true, and where, tomorrow.

The reason insurance changes so rapidly and produces such different situations is that its institutions are created and its administration conducted as results of a continuous series of conflicts between a number of contending forces.

The most important conflict from our point of view is that between the professions and the insurance societies ("Approved societies," *Krankenkassen, caisses).* These societies preceded and prepared the way for governmental systems. They are doing this today in the United States just as they have done it in a host of other countries. They have a multitude of forms: fraternal societies, trade unions, "group" policies of commercial companies, mutual aid associations, industrial plant organizations, religious and racial mutual benefit societies.

These hire doctors or maintain clinics to care for their members. The lot of these "lodge" or "club" doctors is not particularly pleasant, nor is the service that they give something of which their professions are always proud, although there are exceptions. They are, together with a host of other influences, too numerous, complex and extensive to permit of discussion here, building up the machinery of social health service for those who every statistical authority agrees cannot afford it otherwise. Together with professional health education, and the efforts of welfare workers, they are creating a demand on the part of this same poorly paid class for complete and continuous health care.

The politician sees an "issue" that will attract a mass of votes. He gains the support of all these societies by making them agencies for the administration of a system of state insurance. The medical

professions, having given little attention to these developments and their almost inevitable outcome, are caught napping, and awake to find themselves battling for their incomes, their professional standing and the well-being of their patients, against a well-organized body of societies.

Out of this struggle for control between the societies and the medical professions come all the fights over fees, contracts, lay control, "freedom of choice of practitioner," professional secrecy, hasty treatment and a host of other evils that are found in some systems of health insurance. Out of this situation also comes indirectly another set of even worse evils that arise from the effort to give cash and service benefits under the same administration; where the society gives the cash on the instructions of the physician or dentist. Here is the heart of the battle over "certificates of incapacity to work," malingering and a host of questions arising out of lay supervision of professional practice.

Not all of these things are inherent in insurance. As we shall see, when professional associations are alive to the situation before the system is crystallized into law, most of them can be avoided.

But wherever treatment is financed by funds not controlled by the patient, limitations will inevitably be placed on the character of the treatment. It will mean restrictions on the amount of drugs and appliances and on the character of dental treatment. It will mean, in some cases, overworked practitioners giving hasty diagnosis and superficial treatment.

It is these conditions that cause the introduction of insurance to be followed so often by an extraordinary increase in the amount of drugs dispensed and the consequent charges that physicians are reverting to the "dosage" disapproved by modern medical practice. With dentists, this results in too frequent extractions and superficial treatment, because of restrictions on dentures and extensive curative treatment.

The necessity for the physician or dentist to certify that the patient is incapable of working in order to enable him to get his cash benefit is particularly aggravating. The practitioners' standard of convalescence is very different from the insurance societies' standard of ability to work.

Referees are set up to settle these controversial points, and the struggle then turns on control of these referees. Not only does the "paper work" required for insurance records take up the practitioner's time, but also the handling of such records by insurance employes violates professional secrecy.

The societies charge the practitioners with failing to check malingering. Unemployment always brings a great increase in the demand for sickness benefits. Defenders of insurance say that the same increase comes in countries having no insurance, but is not recorded or relieved.

It is charged that all this works to standardize professional services at a low level, to discourage ambition and research in the individual practitioner, to focus attention on mass treatment and mediocre achievements and, therefore, to discourage graduate study and specialization.

All these evils are tied up closely with the dual system of cash and service benefits and the consequent dual administration of societies and professions. The outcome of this conflict has been a steady reduction of the power of these societies in the newer systems and a consequent increase in the influence of professional associations. Several countries considering new systems are seeking ways to abolish entirely this duality of benefits and control.

In spite of all these handicaps and difficulties, we must remember that it is the unanimous, undisputed opinion of even the most bitter opponents of insurance that the conditions under insurance systems are at least preferable to those existing before their introduction. No professional association has ever proposed the abolition of insurance systems.

The dentists in Germany and Austria shared all the sufferings of the physicians. The particular instrument used by the societies to control the practice of dentistry is the clinic. These have been established on a large scale, with low salaries for the dentists employed and, so far, the dentists have not been successful in securing professional control of these institutions.

The defenders of insurance claim that early and universal diagnosis and treatment, which insurance makes possible, saves a multitude of lives and years of illness. It is certain that millions have been given at least a better medical attendance than they had hitherto, and this without the humiliation of poor relief.

Many official statements by professional medical associations affirm that the total sum paid to the whole body of practitioners is far larger than that paid prior to the installation of insurance. This is due to the increased income from the insured, who previously paid very little or nothing. It is also claimed that recent developments promise far better facilities for diagnostic research than are open to the average private practitioner.

Since nearly all of these claims and counter-claims are illustrated by the experience of some country at some time, it is well to look at some of these variations.

When Germany started social insurance, she set the example of combining unemployment, old age and invalidity benefit with medical service to the sick. She also set the example of turning over all of these services to mutual associations which were largely under political influence and therefore quickly became and have continued as parts of powerful political machines. The first concern of their officers is to make a good financial showing; the second, to obtain what they consider are political benefits to their members. They already had contracts with many physicians, with whom they were accustomed to drive hard bargains. In spite of the formation by the physicians of a fighting organization, the *Hartmannbund,* which has conducted a vigorous and continuous defense against the societies, the situation has changed little since the beginning. Germany, therefore, remains an exception to the general rule that, as insurance systems develop, the medical professions gain in power at the expense of the societies. The German societies were so strongly entrenched and the professions so poorly prepared in the beginning that each has held its relative position.

The fact that the number of days of sickness per insured persons increases year after year leads to vigorous charges of malingering. The societies allege that this is due to the weakness, or a worse trait, of the physicians, whom they charge with handing out certificates of inability to work as a means of retaining the good will and fees of their patients. The physicians and some experts in social statistics declare that the increase is due largely to the following: (1) more extensive and general care and consequent registration; (2) earlier diagnosis and treatment of ailments once considered unimportant; (3) most significant of all, the war, and postwar inflation and economic depression, which have weakened the physical resistance of the entire population.

At any rate, the cost of German sickness insurance has risen at such a rate as to threaten the general breakdown of the whole system. The necessity of some change is recognized by all, but the resistance of the mass of the voters receiving insurance relief is so great that the Reichstag did not dare to adopt the strenuous measures necessary to afford relief. Therefore, under the emergency clause of the new German constitution, a "presidential decree" was issued, July 26, 1930, which altered some of the most important sections of the insurance law.

In the explanation introducing this decree, it is pointed out that the net expenditures for sickness insurance in 1928 was 1,865,000,000 marks, as contrasted with 470,000,000 marks in 1913. When to this is added the contributions for unemployment, invalidity, old age and death, the total contributions of employes and employers amount to 16 per cent of the total wages.

The decree introduced a large number of economies, mostly in small details. The attitude of the governmental authorities in the conflict between the doctors and the insurance companies is shown by the fact that the whole tendency of the new regulations is to strengthen the control of the societies and weaken the position of the physicians.

That the physicians' incomes were already almost unbelievably low is shown by the accompanying tabulation supplied by the Berlin correspondent of the *Journal of the American Medical Association*.[5]

Yet in spite of the miserable condition of the German physicians under the insurance system, it remains true that the most violent enemies of German sickness insurance and the great medical societies

Percentage of Physicians of Berlin from the Yearly Class Born Between 1866 and 1898.

Assessed Income Tax.	
Under 500 marks ($119)	58.4
500-1,000 marks ($119-$238)	23.7
1,000-1,500 marks ($238-$357)	8.9
1,500-2,000 marks ($357-$476)	3.6
Above 2,000 marks ($476)	5.4

of Germany agree in saying that the present condition is superior to that which preceded insurance. Most significant of all, this German experience, carefully studied by official bodies of other countries, resulted in the adoption of similar legislation in neighboring nations.

Great Britain offers the best illustration of a second stage in the development of insurance. Lloyd George carried the first insurance legislation through Parliament in 1911. It was introduced, as such insurance usually is, not fundamentally as a means of treating health, but as a means of treating poverty, a fact which has had very dire effects on insurance administration in all countries. The law was put through with little preliminary investigation and so suddenly that the British Medical Association was caught largely unprepared. It hastily summoned its resources of knowledge, publicity and political influence and succeeded in greatly improving the original draft of the law. One of the most important of these changes took the control of medical treatment out of the hands of the "approved societies" and placed it under direct governmental control with professional cooperation. What was more significant, the medical profession (and here I would emphasize that the dentists played a very important part, especially in the later stages of this struggle) succeeded in establishing itself so firmly in the beginning that it has been able con-

5. Foreign Correspondence, J.A.M.A., 90: 1195 (April 9) 1927.

tinuously to increase its influence. As to the results, perhaps the best thing to do is to let the medical profession speak for itself. In its official statement to the Royal Commission on National Health Insurance in 1926, the British Medical Association said:

> In the year 1922 both the Representative Body of the Association and the Conference of Representatives of Local Medical and Panel Commissions declared that the measure of success which has attended the experiment of providing medical benefit under the National Health Insurance Act system has been sufficient to justify the profession in uniting to ensure the continuance and improvement of an insurance system.
>
> a. Large numbers, indeed whole classes of persons are now receiving a real medical attention which they formerly did not receive at all.
>
> b. The number of practitioners in proportion to the population in densely populated areas has increased.
>
> c. The amount and character of the medical attention given is superior to that formerly given in the best of the old clubs, and immensely superior to that given in the great majority of the clubs which were far from the best.
>
> d. Illness is now coming under skilled observation and treatment at an earlier stage than was formerly the case.
>
> e. Speaking generally, the work of practitioners has been given a bias towards prevention which was formerly not so marked.
>
> f. Clinical records have been or are being provided which may be made of great service in relation to medical research and public health.
>
> g. Cooperation among practitioners is being encouraged to an increasing degree.
>
> h. There is now a more marked recognition than formerly of the collective responsibility of the profession to the community in respect of all health matters.

As to its effect on the income of the profession, perhaps it is better to let an impartial outside observer speak, particularly as this statement could be confirmed by many quotations from leading British physicians. The Commission on Medical Education published a study of "Medical Education and Related Problems in Europe," in April, 1930. On pages 128-129, this report says concerning the effect of the British health insurance system:

> The income of the profession has undoubtedly been increased by the insurance plan. It is doubtful if the system has actually diminished the income of a single doctor inasmuch as the capitation fee is several times larger than the amounts paid under previous systems of contract practice. The present insurance plan provides medical care and other benefits for approximately the same elements in the population that were covered by the miscellaneous organizations in the past. Raising the capitation fee above the club fees of the former period has also had a tendency to increase private fees. Furthermore, doctors are now paid for mileage in the rural districts which was not covered under the previous plans. Many physicians who do not do insurance work are getting better fees now because the Insurance Act has tended to raise all medical remuneration.

There have been loud and long complaints of malingering in Great Britain. There have been charges and countercharges as to connivance of physicians, yet at no time has the condition as to either the extent of malingering or the bitterness of antagonism between physicians and "approved societies" ever reached the boiling point that it has so long maintained in Germany.

Although dentistry was only an "additional" benefit in the original British law, the universal demand for dental service on the part of the insured caused it constantly to gain in importance. The dental profession, granted legal recognition only in 1921, was also active, not only in urging the extension of dental benefit under insurance, but also in determining the conditions of that extension.

In 1930, the position of the dentists and dental care was fixed by regulations, having the force of law, that gave the profession a large share in administration

and reduced lay interference to a minimum. This position is the direct result of more than a decade of continuous education by dental associations.

France is the latest of the great nations to introduce sickness insurance, and she did this only after long study of existing systems. The law was actually held in suspense for more than two years after it had once been passed by the legislative body. During this time, professional organizations were greatly strengthened and consolidated for the purpose of defending their interests under the law, and large sums of money were raised and expended for propaganda. Both physicians and dentists had members of their profession in the Chamber of Deputies, who represented them and also advised them as to political tactics. The result was then summed up by Professor Balthazard, head of the National French Medical Association:

> I admit that I am somewhat proud of the result obtained; after three years of efforts, of passionate discussions, of intense propaganda, we have the right to proclaim ourselves victors.
>
> Thanks to the tenacity of the French medical corps, thanks also to its clear vision, the social insurance law will not be, as in Germany, a powerful factor in the demoralization of the working class, and by the reaction *(contre-coup)* of the medical profession, may even become one of the most important elements in the development of social hygiene and preventive medicine.
>
> The Government has happily accepted our conception.

Both the physicians and the dentists have representatives on practically all administrative bodies concerned with insurance, including those of the societies. There is absolutely free choice of physicians or dentists. Professional secrecy is guarded. Payments are made by the patients direct to the practitioner, the patient then recovering the contribution of the insurance company direct from the fund. In general, nearly all of the questions that have been so bitterly fought over in Germany have in France been settled in favor of the medical professions.

It is too early to make any predictions as to the general working and effects of the law, which only went into operation in October, 1930. It does at least seem that the French scheme starts off under more auspicious conditions than that of any previous system.

German observers, at least, share this opinion as is shown by the comment of Dr. Kurt Finkenrath in the *Klinische Wochenschrift,* June 28, 1930. In this article, which is a lengthy discussion of the French law in comparison with the German system, he says:

> A dominant part in this struggle was taken by the French medical profession, which, within a few months raised a fund of over a million francs to prevent the overriding of its wishes. The demands of the French medical profession were, for us, very comprehensive, and were put forward at the time as a minimum program maintained by all the medical organizations of France. In the resulting law, a large share of their demands were granted.

If now we consider the proposals set forth for new legislation in the British dominions, we are justified in concluding that the lines of evolution previously described indicate that the insurance systems of the future will be based on these fundamental principles:

1. A complete separation of medical treatment from all forms of relief.

2. Control through professional associations of the administration of this treatment.

3. Reduction of the place that insurance occupies in a general social health program and corresponding extension of other forms of health care.

4. Complete separation of all insurance organizations from sickness treatment and health measures.

The medical professions have stated that they wish the establishment of these principles. The insured, as far as they have shown direct interest, seem to agree that nearly all these changes would bring a better care of public health. Even the societies, as far as they are in a real sense "fraternal" or "mutual," seeking the good of their members, have offered little opposition. The more recently installed types of insurance are including most of these principles. It is important that physicians and dentists should know the reasons for insisting on these principles as a basis for any proposed system of insurance.

It is as certain as anything yet in the future can be that some general compulsory plan of health insurance will be proposed in one or more of our forty-eight states within a short time—probably in some of the legislatures now in session. If any such law is adopted, it will profoundly affect the income, personal and professional freedom, office work, methods of practice and nearly every other phase of the lives of the dentists in that state directly, and those in other states only a little more indirectly. Whether such legislation is passed and, if so, in what form, depends primarily on the preparation of the professional associations to meet this inevitably approaching situation.

Nor can dentists any longer stand back and let the physicians bear the brunt of the experimenting. Recent legislation demonstrates that henceforth all medical professions are included from the beginning and share a common fate. Their united strength and knowledge is needed to protect practitioners and patients.

THE MEDICAL INSURANCE SITUATION IN THE UNITED STATES*

By NATHAN SINAI, D.P.H., Ann Arbor, Mich.

CONCURRENTLY with the developments in scientific knowledge, like changes in both the social and the economic aspects of medical care have taken place. While one professional group may have advanced farther in the cycle of these developments, there is an apparent tendency on the part of the other professional groups to follow the leader rather than to survey new paths or make new analyses of objectives. With respect to scientific knowledge, the tremendous impetus given to research during the past half century has resulted in the collection of a great mass of information. Every addition to this information results in a further complication of the problem of public distribution. It is this problem of distribution which is giving concern to both professional and lay groups today.

Professional training has attempted to keep pace with the contributions of science. The evolution of this training has

*Read before the Section on Dental Economics at the Midwinter Clinic of the Chicago Dental Society, Feb. 3, 1931.

brought about a shifting of emphasis from the so-called apprenticeships of early days to the familiar formal type of education seen today. At intervals, the period of formal education has been increased and the period of apprenticeship has been decreased, until, as is to be seen in medicine, the apprenticeship has been almost entirely replaced by the formal training and the semiformal internship.

Changes in professional education have occurred too often without careful study of both public and professional needs. It is apparent that certain of the failures in education are the result of a lack of what the industrialists would term a "job analysis," an analysis to determine how the future members of a profession may render the greatest service.

Directly resulting from the gradually shifting emphasis in training is to be noted the changing aspect of private practice. Originally, the general practitioner, both in medicine and in dentistry, was the medium through which the public received the great bulk of medical service. It was reasonable to expect that as training in specialties became more and more emphasized, there would be a greater and greater division of labor in practice. Gradually, then, this division of labor has shown a progressive development, especially in medicine, and, to a somewhat lesser degree, among other professional groups. Even in these other groups, there is a tendency toward this same development, and signs of possible future divisions may be noted. In dentistry, there is to be seen the rise of specialization in orthodontia, in exodontia, in the treatment of pyorrhea and in other fields. It is safe to predict that cleavages which are now indistinct may, before many years, become distinct. Whether or not this is a trend desirable for both dentistry and the public is a matter which should give some concern to the profession.

In recent years, the public has been taking more and more interest in the standards that govern medical practice. It is a rule of political science that when a legal monopoly is granted, the public not only accepts a partial responsibility for that monopoly, but also demands the right to share in the control of its operation. Early in the development of medical care, the professional groups, realizing that they themselves would be unable to control standards, requested the public to set up machinery for such control. The public answered, in the only legal way at its command, by passing laws and establishing various boards. Today may be seen a multitude of conflicting standards and an increasingly conscious public asking what it is all about. The leaders in the field of medical care, viewing their own structure with all of its complications, overcome by its very proportions, are too often prone to adopt either a hopeless and helpless attitude or one of antagonism.

In the operation of this structure, there arise questions of public rights and questions of private or professional rights. It is an admitted fact that problems of this sort may, in the course of time, work their own solutions. But this entails the use of trial and error processes that are not only time-consuming but also very costly. In questions concerning medical care, the cost may be high not only to the public but to the professions as well.

The problems of adjusting public rights and private rights have given rise to the vocation of social service. This vocation, represented by the social worker, attempts to bring about something approaching a balance between these rights. In this movement, too, may be seen a changing emphasis. Whereas during the earlier years of social work the emphasis

was placed on the need for fitting the environment to man, in later years the greater emphasis has been placed on the fitting of man to his environment. As examples of the first objective, we have the important attempts and results in industrial reform. As examples of the second objective, we have the efforts of the case worker, the social psychiatrist and others who typify this field. Today, in social service, there is an attempt to seek a middle ground so that the environment will be fitted to man, and also man will make some adjustment to fit himself to the environment. It must here be remembered that the system of medical care is a part of man's environment.

It is a basic principle in science that one who plans an experiment shall review the literature relating to the project for the purpose of deriving the maximum benefit from all previous trials and errors. What is true of laboratory research is equally true of research in the field of medical economics.

On closer examination of the field of medical insurance, the Committee on the Study of Dental Practice of the American Dental Association realized the necessity for widening its scope beyond the possibilities of its appropriations. On learning of this situation, the American College of Dentists requested the privilege of making a contribution to the welfare of both the medical and the dental profession. To that end, the college has taken over full responsibility for the study of medical insurance, including both the library research and the European field study.

To the average physician and dentist in the United States, immersed in his practice and in the sciences that control his practice, medical insurance is abhorrent. In a hazy way, the subject is tied up in his mind with a system of horrors called "panel medicine" or "panel dentistry." While he speaks glibly of the panel system, his ignorance of it is appalling. Mr. Simons has already shown that medical insurance is more than the panel system. It is a world-wide movement that amounts to a flood. The question as to whether the United States will stand like a rock in the path of this flood, causing it to divide and flow to the north and the south, is one for the professional groups in this country to determine for themselves.

In the discussion of medical insurance in other countries, certain conditions that led to the adoption of insurance measures were brought out. If we turn from a view of these conditions to a study of the situation in the United States, we see that all of the ingredients of medical insurance are to be found in this country. It has been shown that certain of the ingredients are dangerous. The problem, then, before the professional groups is whether the ingredients are to be mixed and, if so, who shall decide the proportions which shall go into the mixture.

Today no country has a more extensive system of nongovernmental insurance than the United States. American commercial insurance companies with billion dollar operations are common, and recently, there has been a great expansion of so-called "group insurance," written on industrial employes without preliminary medical examinations. Here, too, are found numerous fraternal organizations and mutual benefit associations supplying medical care on a contractual basis with physicians and, in a few instances, with dentists. In these relationships are to be seen practically all of the conflicts with professional groups that have accompanied the earlier forms of compulsory insurance. Likewise, in operation at present, we see for the first time the Federal

government introducing what amounts to a medical service insurance for veterans, and the expenditures by the government up to Oct. 31, 1930, were $442,229,044 for medical and hospital service.

Another characteristic development which is to be noted in this country is the operation of a system of compulsory health insurance called "workmen's compensation." This type of insurance came with typical American speed. In 1908, Congress passed the first law to cover workmen subject to Federal jurisdiction. Three years later, Wisconsin started the procession of states adopting workmen's compensation laws, and, by 1915, thirty-four states had fallen into the line headed by Wisconsin. Today, workmen's compensation laws are operative in all but four states.

In the structure of workmen's compensation legislation in this country, there is to be noted the same evolutionary process described in the previous discussion. There is an opportunity, now largely overlooked, to study right here nearly all of the problems that have arisen in the European systems. All phases of the conflict between physicians and societies—free choice of a doctor, fee schedules, malingering, red tape—have already developed wherever private companies or associations are permitted to function. There are to be seen the usual complaints made by the companies against professional groups and the usual complaints of the professional groups against insurance companies. It would be difficult to have anything said about the relations of physicians to workmen's compensation legislation which has not already been said over and over again in the discussions relative to compulsory health insurance. Finally, there is conclusive evidence that the profession in the country has followed the example of its European confrères and has overlooked an opportunity to direct legislation and its operation.

At practically every legislative session in those states where compensation laws exist, proposals have been made for the extension of these laws, and in a goodly percentage of these cases, additional legislation has been enacted. The greatest advance in such legislation was in the inclusion of occupational diseases as subject to compensation. Viewing the extensions that have already been made, one may only conclude that, after the fundamental machinery has been constructed, it is comparatively easy to pass amendments making the laws more and more inclusive. The workmen's compensation acts of today may be easily amended to include occupational diseases by changing the word "accident" to "injury," and it is within the realm of possibility that changing the word "injury" to "illness" may be the foundation for a system of compulsory medical insurance.

The relationship of dental care to workmen's compensation has been brought out through concurrent cases that have arisen in Colorado and Pennsylvania. In the Pennsylvania case, dental expense resulting from an accident causing injury to the teeth was allowed, and the board held that "surgical and medical services, medicines and supplies" include all services necessary to repair a physical injury whether rendered by a physician, surgeon or dentist. This ruling, with but few exceptions, is now general throughout the states.

The place of the dentist in the treatment of occupational diseases is one to which little study has been given. In any compensation law affording a blanket inclusion of occupational diseases, one may expect questions to arise concerning the effect of sugar and flour on the teeth of bakers, the effects on the teeth of indus-

trial workers subjected to mercury and nitrous fumes and likewise the effect in industries of the use of sulphuric acid. In the absence of definite information relative to these effects, one may expect controversies to arise. These controversies will more and more embroil the dental profession because they will be concerned with the differentiation between the very high prevalence of dental disease found generally and the abnormal incidence occurring in particularly hazardous occupations. It may be expected, then, that as workmen's compensation becomes more and more embracing, dentists will be brought more and more within the scope of such legislation.

Nothing is more illuminating than the following concise statement made by the Committee on Insurance of the New York Chamber of Commerce: "The connecting link between accident compensation and sickness insurance is found in occupational diseases. As the principle of insurance has been applied successfully to the solution of one of these problems, increased confidence has been given that it will be equally available in dealing with disease and destitution."

One of the most dynamic ingredients of all, one which has potentiality for either good results or bad results, depending on its ultimate use, is the general dissatisfaction with our system of medical care. This dissatisfaction is very evident among the professional groups and in most cases is of an economic nature. Also, with respect to physicians and dentists, there is a fear, greater on the part of the physicians than on that of the dentists, that encroachment by public and private agencies is constricting the fields of private medical service. This fear is much like the fear of health insurance. No comprehensive studies have been undertaken to determine the extent of the encroachment and, of equal importance, the effect on private practice. In this connection, there will always arise the question as to what degree a given encroachment has improved public education, with the result that private practice has actually been increased. Again, within professional groups, there is some dissatisfaction with specialization. The whole subject of specialization is one that is today giving much concern to medical leaders who are facing the problems of training the students who are to practice tomorrow.

The dissatisfaction so evident among the professions is even more apparent among lay people. It must be remembered here that while man has been called a reasoning animal, he reasons only at certain times; he is emotional all of the time. Therefore, public dissatisfaction may be extremely dangerous.

As concerns the whole question of medical insurance as a part of social legislation, it is interesting to note that if we prepare a chart showing the peaks of economic prosperity, the declines of economic recession and the valley of depression and, further, if we indicate on this chart the periods of prosperity, recession and depression in social legislation, almost invariably we find that the waves of social legislation reach their peaks following the valleys of economic depression. This is particularly significant in view of our present world-wide depression. The reverberations of social legislation are already to be heard. Before almost every state legislature, proposals are being made to provide unemployment insurance, old age insurance or pensions, amendments to workmen's compensation acts and like types of legislation.

These are all evidences of social change in which professional groups must become interested. If there was ever a need

for these groups to pause and objectively study movements in medical care, the need is now present. If there was ever a need for petty animosities and energy-consuming antagonisms within professions and between professions to be forgotten, the need is here. Changes that take place may be directed by the professions or there is danger that they will be directed for the professions. If the changes are directed for the professions, there is the grave possibility that they will be directed on the basis of emotionalism, with its resultant harm to both the professions and the public. While, as has been shown, Germany had her Bismarck and England her Lloyd George, we in the United States have the winds of public opinion and forty-eight legislative weather-vanes to determine wind direction.

QUANTITATIVE INCIDENCE OF LACTOBACILLUS ACIDOPHILUS IN THE ORAL CAVITY AS A PRESUMPTIVE INDEX OF SUSCEPTIBILITY TO DENTAL CARIES*

By F. E. RODRIGUEZ, B.Sc., D.D.S., Baltimore, Md.

IN a paper recently published,[1] I described in detail a method of determining, quantitatively, the incidence of *L. acidophilus* in the mouth. The method, briefly described here, consists of the employment of an agar-serum medium which, immediately after inoculation with definitely measured amounts of contaminated saliva, is incubated in an anaerobic jar containing 10 per cent carbon dioxid as the only gaseous environmental element present during the whole period of growth and development. By the use of this technic of cultivation, the acidophilus colonies develop on the surface of the serum-agar medium with a luxuriance and individual size unobtainable by any other known bacteriologic procedure, and which differentiates them sharply from the other mouth bacteria. Furthermore, besides the intensity of development, there occurs around each acidophilus colony a reaction of the medium, in the nature of a white acid precipitate of the serum element which renders the counting of colonies a simple procedure by plain visual means. (Figs. 1-3.)

Two points were discussed at length in this paper[1]: (1) that, in keeping with the requirements of other members of plant life, certain bacteria are accelerated in their growth by the presence of amounts of carbon dioxid greater than the ordinary atmospheric carbon dioxid (0.03 per cent); (2) that the oral acidophilus bacilli are not simple aerobes, as commonly supposed, but aerophilic microorganisms requiring at least a partial anaerobiosis for their best development.

*Read before the Section on Biologic Sciences and Research at the Midwinter Clinic of the Chicago Dental Society, Feb. 4, 1931.

1. Rodriguez, F. E.: Method of Determining Quantitatively Incidence of Lactobacillus Acidophilus-Odontolyticus in Oral Cavity, J.A.D.A., 17:1711-1719 (Sept.) 1930.

EFFECT OF PROPHYLACTIC MEASURES ON INCIDENCE OF L. ACIDOPHILUS*

Case	Age	Caries	Count per C. c.	A	B	C^1	C^2	C^3	C^4	D	E	F	G	H	I	
B1	12	3	500,000	360,000	100,000	36,000	18,000			11,000						0-50
B2	10	5	1,400,000	900,000	200,000	0										
B3	15	7	120,000,000	93,000,000	21,000,000	5,000,000	7,200,000	6,300,000	100,000			150,000		82,000		0-620
B4	9	3	6,400,000	4,700,000	320,000	52,000	0				0					
B5	13	4	10,000,000	9,200,000	6,700,000	1,250,000	270,000			0		20,000		17,000	1,170	0-1000
B6	12	5	7,300,000	1,790,000	71,000	0										
B7	16	2	9,100,000	8,800,000	5,360,000	4,000,000	300,000		148,000		102,000	2,050			400	
B8	13	4	86,500,000		36,000	19,000				60,000		15,700		600,000	230,000	0-50
B9	9	5	90,000,000		480,000				77,600		80				0	0-480
B10	13	2	320,000	717,000	129,200	92,000	11,000			900		250		800		0-70

*A, large cavities only filled; B, all cavities filled; C^1, one prophylactic treatment monthly; C^2, two prophylactic treatments monthly; C^3, three prophylactic treatments monthly; C^4, four prophylactic treatments monthly; D, antiseptic solutions employed; E, more than four brushings daily; F, carbohydrate intake reduced; G, cod liver oil prescribed; H, orange juice added to diet; I, vegetables, orange juice and proteins added to diet. The figures obtained by preventive measures are in boldface type.

In presenting the various factors in the technic, and emphasizing the skill and care required in carrying out a test of this nature, it was made clear that the procedure is time-consuming and rather complicated from the standpoint of practical routine application in the average busy bacteriologic laboratory. I wish to add that every possible means of simplification of this method has been tried, from the actual use or modification of the various standard colony count procedures employed in general medical bacteriology to the use of differential mediums of various inhibitory or stimulating p_H adjustments; also, selective mediums containing dyes or vegetable juices of high vitamin content. After all these attempts, extending over a period of years, I have most decidedly failed to find any simple, quick way of making the test. Therefore, in order to rule out, as far as possible, from a research problem of this type the element of guesswork, all efforts at simplification have been temporarily abandoned for the method originally advocated, which, although cumbersome, is accurate and dependable in all respects.

During the past ten years, quite a large number of research data have been accumulated dealing with the apparent relationship of *L. acidophilus* and dental caries. The work of McIntosh, Lazarus-Barlow and James[2] in England; my investigations,[3] and those of Bunting and his associates at the University of Michi-

Fig. 1.—Plating from saliva dilution showing one L. acidophilus.

2. McIntosh, James, et al.: Brit. J. Exper. Path., 3:138 (June) 1922.

3. Rodriguez, F. E.: Mil. Dent. J., 5:199-214 (April) 1922.

gan[4]; Jay[5]; Morishita,[6] and others in this country, have brought to light a newer bacteriologic conception of this disease, which has had the tendency to reaffirm on modern grounds the original millerian theory of tooth decay. With those who, like me, have followed closely this newer development, the belief prevails that, so far, only the surface has been broken and that an immense amount of labor remains to be done from the standpoint of both pure and applied bacteriology before conclusions of any practical character can be recommended. It is, then, with this thought in mind that I present the studies that follow, based on a number of cases too limited to permit generalizations in so complicated a problem as dental caries is, but which, in my judgment, suggest the importance of the question of the rôle of bacteria in the phenomena of dental caries and its consideration in any efforts aiming at the control of the disease.

Fig. 2.—Plating from saliva dilution showing five acidophilus colonies.

4. Bunting, R. W., and Palmerlee, Faith: Rôle of Bacillus Acidophilus in Dental Caries, J.A.D.A., 12:381 (April) 1925. Bunting, R. W.; Nickerson, Gail, and Hard, Dorothy G.: Dent. Cosmos, 68:931 (Oct.) 1926. Bunting, R. W.; Hadley, Faith P.; Jay, Philip, and Hard, Dorothy G.: Am. J. Dis. Child., 40: 536-548 (Sept.) 1930.

5. Jay, Philip, and Voorhees, Ralph: Dent. Cosmos, 69:977-980 (Oct.) 1927.

6. Morishita, K.: J. Bacteriol., 18:181-198 (March) 1929.

RELATIVE SPECIFIC L. ACIDOPHILUS INCIDENCE UNDER NORMAL CONDITIONS OF SUSCEPTIBILITY

The presence or absence of *L. acidolphilus* in the oral cavity has, heretofore, been determined by means of a qualitative method of bacterial culture which depends for the process of cultivation on the

initial employment of an acid broth. The growth obtained in these tubes of acid broth, after proper incubation, is then checked microscopically for morphologic characteristics of the organism, and the fluid broth chemically tested for *p*H changes; or else, or perhaps in addition to these procedures, the broth culture is plated out on glucosed solid mediums so that the surface colonies obtained may be checked and confirmed for form and acid-producing power. There is no question that this method, in the hands of laboratory technicians of experience, does give information of much value, particularly in the examination of negative cases. In fact, it has been the only method generally used, and, through its use, we have obtained valuable data and have aroused interest in the study of the bacteriologic phases of tooth decay.

It is obvious that this qualitative method affords no information on the actual incidence, numerically speaking, of the bacilli present at various times in the normal, slightly pathologic or frankly diseased mouth. This knowledge is of no significance in the negative case, which, as was said before, is easily determined by the acid broth method; but it becomes of supreme importance in dealing with the positive case (bacteriologic), especially that type of positive case either free of decay or with a history of but slight decay. It is, of course, understood that, on the basis of a strictly qualitative method of bacterial culture, no difference can be established between the case with

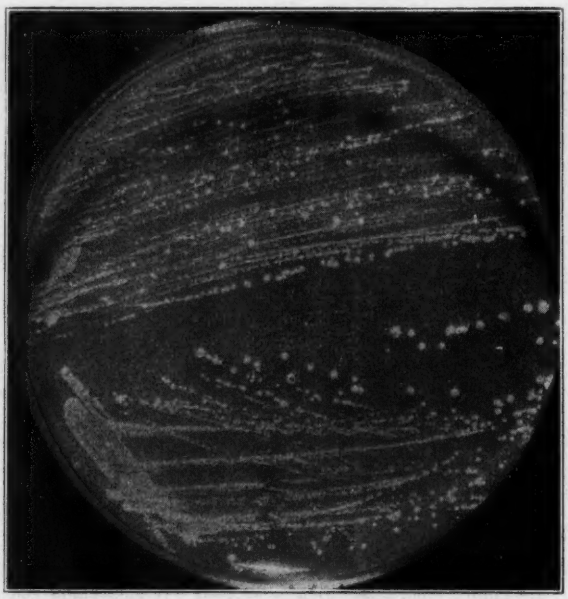

Fig. 3.—Plating showing effects on medium of stock pure culture of L. acidophilus.

relatively few bacilli in the mouth and the case that is overwhelmed with probably many tens of millions of microorganisms per cubic centimeter of saliva.

The report that follows deals with the quantitative differences in acidophilus content of the salivary fluid of persons of various ages before and after preventive measures were instituted.

With a view to determining quantitatively the acidophilus content in the mouths of clinically positive but untreated cases, a fairly large number of persons were examined bacteriologically. A series of twenty-five of these cases, in persons ranging in age from 6 to 50 years, is presented in Figure 5.

It will be seen, as shown by the curve as a whole, that there are two distinct fluctuations in both the childhood and the adult periods depicted. From 6 to 17, the bacterial count varies grossly from over 81,000,000 to 5,000,000 colonies per cubic centimeter of the examined saliva. In the adult group, the fluctuations vary from about 6,000,000 at age 18, to a little over 10,000 colonies at age 50. Attention is invited to the fall of the graphic curve at about age 10 and its steady rise as age 14 is reached. Likewise, it is interesting to note the steady fall from about age 14 to the eighteenth year of life in this particular group of cases. The figures are, of course, not constant in every patient examined. There are colony-count variations from patient to patient, and from day to day in the same patient, which are quite considerable numerically. A given series of cases of similar ages to those of the group depicted above the correlation,

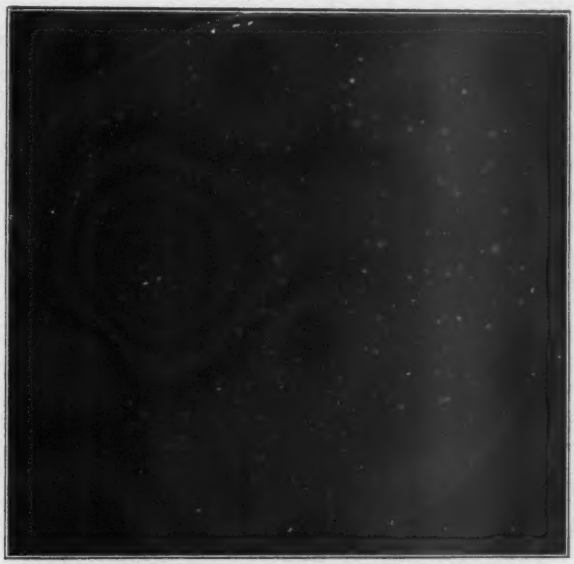

Fig. 4.—Plating from saliva dilution showing absence of L. acidophilus. No reaction of the medium has taken place.

when plotted, will afford approximately the curve shown in the chart.

The adult group is interesting in that the incidence of acidophilus diminishes gradually but rapidly from age 30 to age 50. It is noticeable that, in this adult group, as in the childhood group previously mentioned, no acidophilus-negative cultures were obtained. Generally speaking, it may be said that the total actual incidence of acidophilus, as shown in this representative chart (Fig. 5), is in accord with our clinical experience in regard to the varying susceptibility to dental caries. Although no figures as to the number of carious teeth are given for any of the persons composing this group (for no correlation with clinical findings was sought at this time), only persons with a clinical history of active caries were selected for the study.

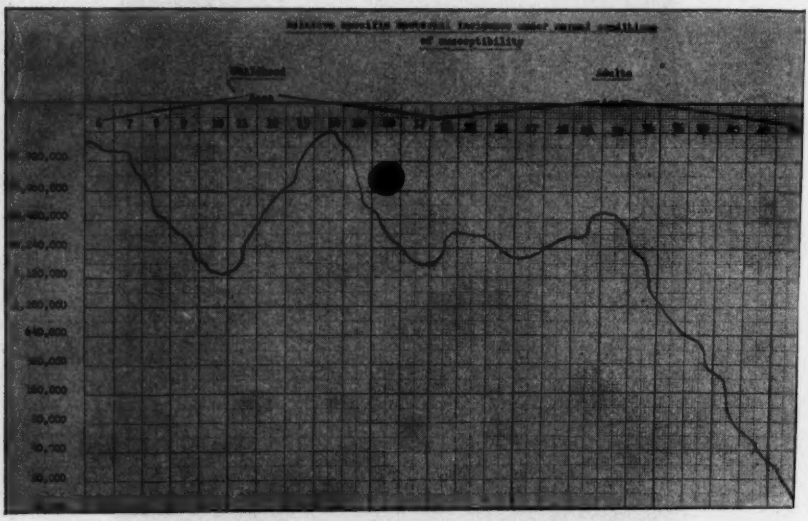

Fig. 5.—Relative specific bacterial incidence under normal conditions of susceptibility.

At this point, the thought would naturally occur to many: If these bacteria are specifically related to the etiology of dental caries, why does not the person giving a count of a little over 10,000 colonies per cubic centimeter of saliva show the same extent of tooth decay as the child of 7 years, since they have the same destructive influences in the mouth, the difference being only numerical? This query is justified in view of the fact that the same cases mentioned confirm in all respects our old clinical experience of extensive decay in the early years of life and are but very inconstant and relatively insignificant at or after middle age. This question will be, in a very small part, answered by the study charts that follow. It seems that the occurrence and rapidity of the carious process bear a definite relationship to the number of acidophilus bacilli inhabiting the mouth. The number may fluctuate from several tens of millions in the acutely affected case to only a few thousand, or, at times, they may be

absent from the mouth, in the case of the relatively nonsusceptible or in the treated case. Massiveness of infection or infestation, in this case, plays the same decisive rôle as in the case of the various infectious or parasitic diseases.

THE CONTROL OF ORAL ACIDOPHILUS OVERGROWTH BY A COMBINATION OF PREVENTIVE MEASURES

The accumulated experience of over fifteen years' constant study of the microbial phases of dental caries has convinced me that there is not available, at present, any one specific line of treatment leading to the control of the mouth bacteria suspected as being causative of caries. Furthermore, the same assertion, in my judgment, holds true of the various schools of thought, which limit their attack against this disease to certain specialized lines of treatment. This statement is not made with the desire to minimize or detract from the notable work of various distinguished workers in this field. The advent, for instance, of nutritional chemistry in preventive dentistry research has produced new and unquestionably powerful arms of combat in the fight against tooth decay; yet, in the light of clinical and histologic evidence, we cannot, as yet, consider strictly dietary measures as the sole means of prevention.

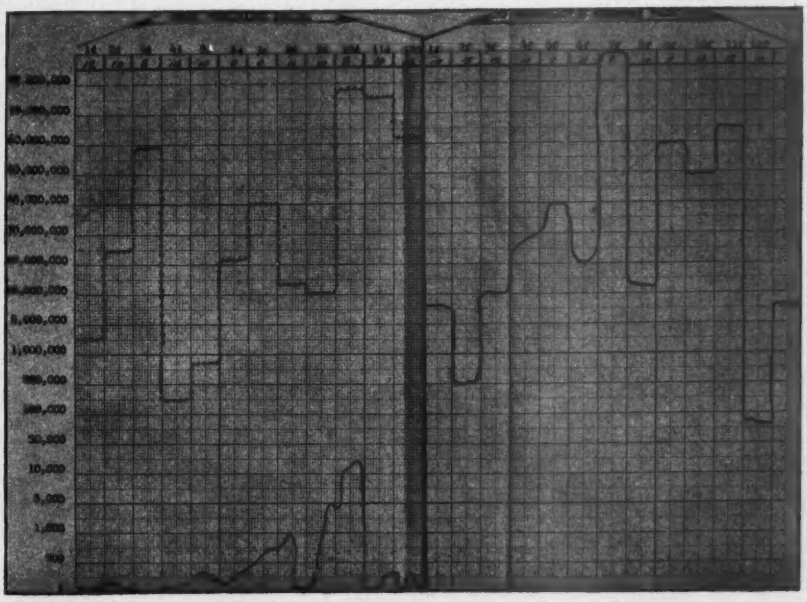

Fig. 6.—Effects of preventive measures in controlling acidophilus incidence among highly susceptible children.

The observations recorded in the accompanying table support my convictions in this respect. These data represent the collective study of a series of patients ranging in age from 9 to 16 years of age, i. e., the most susceptible periods of life

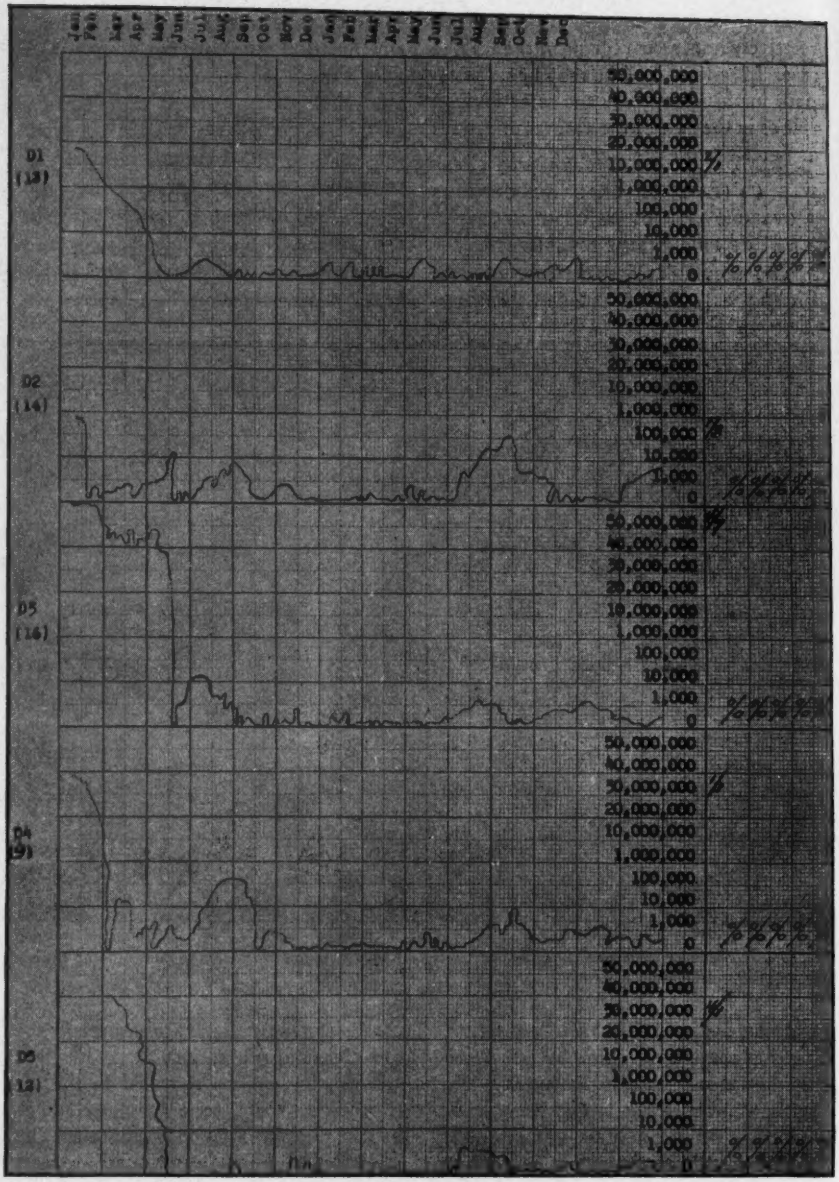

Fig. 7.—Observations of two years' duration showing reduction of acidophilus flora and consequent absence of active caries. (Compare Fig. 8.)

from the standpoint of dental caries. The age of the patient and the number of carious teeth present at the time of the examination are recorded in horizontal order under the respective headings. The observations relating to this group were conducted as follows:

After the selection of the cases from the standpoint of clinical history of caries was accomplished, the age of the patient and the number of carious teeth were recorded and filed separately for each individual. Each case was then subjected to a quantitative bacteriologic test for *L. acidophilus*. The results of these tests (column 4) were entered on each individual record. Up to this time, the only instruction given the patients was to follow their customary routine of personal hygiene until directed to do otherwise.

The week following the termination of the first quantitative bacterial determination, clinical treatment consisting of the insertion of fillings was instituted. All the patients except two (B8 and B9) were again bacteriologically examined. Only the larger cavities of decay had been taken care of by the usual operative procedures. The result of this second examination follows the initial count and is under column A. The filling of the remaining carious teeth was then completed in the whole series of cases, when the third bacteriologic test was made (column B).

Let us, at this point, observe the results obtained. It will be noticed that the original counts fluctuate from 120,000,000 colonies, in Case B3, to 320,000 colonies, in Case B10. The figures correlate somewhat with the clinical condition, namely, seven cavities in the first and two in the second case. The first phase of treatment (fillings) served to reduce the acidophilus flora considerably, but not so markedly as is shown under column B after the completion of all filling operations. The beneficial effect of treatment is readily seen in the decided drop in counts, although, with the possible exception of cases B6, B8 and B10, it was felt that these patients still presented an oral environmental condition supporting a fairly rich acidophilus flora in spite of the operative treatment.

The next preventive measure considered was the application of so-called dental prophylactic treatments (scaling, polishing of tooth surfaces, etc.) plus the application of 10 per cent silver nitrate to all occlusal fissures in the molar region. It will be observed in examining column C (one treatment monthly) that here, for the first time, except for cases B3, B5 and B7, the acidophilus growth has been much diminished. Two of the cases (B2 and B6) dropped into the negative class. So consistently negative were these two cases, provided, of course, the treatment was continued regularly, that, after repeated examinations, it was decided to set them aside for future observation, with no other type of treatment.

No such decidedly good results were manifest in the remaining eight cases. The application of two or more "dental prophylactic treatments" served to improve conditions in four more cases, as shown by the table (C^2 C^3 C^4). These treatments *per se* were not found sufficiently effective to bring all the patients within what I may be permitted to call a "safety zone" of acidophilus incidence, two proving the exception.

At this point, and continuing for about one year, there began a series of administrations of very simple dietary and medicinal measures the nature of which is shown in the table. A brief analysis of these various combinations of preventive measures is as follows:

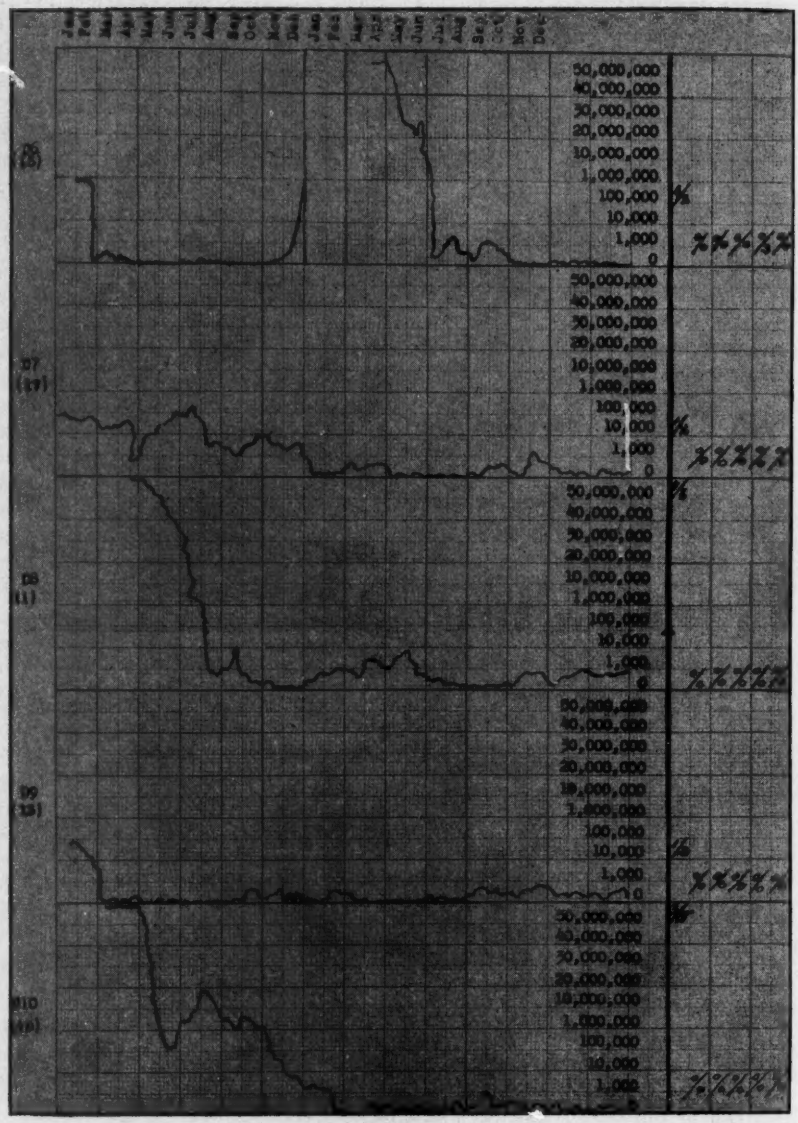

Fig. 8.—Observations of two years' duration showing reduction of acidophilus flora and consequent absence of active caries. (Compare Fig. 7.)

Cod liver oil, a teaspoonful after each meal, given each patient during the course of the observations, was not, of itself, sufficient to reduce the counts obtained after the application of "dental prophylactic treatments." It is probable that it exerted a favorable influence when combined with other preventive measures.

One quart of milk was drunk daily by each individual.

Antiseptic solutions used consisted of: (1) a 0.4 per cent solution of tincture of iodin in water as a mouth wash[7] twice daily; (2) metaphen-hexylresorcinol combined in treatment as recommended by Bunting and used according to his directions. The iodin treatment rendered one of the cases (B5) negative for the first time and improved notably Case B1. Bunting's treatment improved most notably Case B.0. As may be seen, antiseptics of this type were found effective in reducing the acidophilus flora in these particular cases.

Employment of more than four brushings daily was effective in maintaining Case B4 at or near the negative class and caused a most notable improvement of B9, and, to a lesser extent, of B7.

Reduction of carbohydrates to a minimum (no candy, pastries or sweets of any kind allowed, and but a very small amount of bread) solved the problem of acidophilus overgrowth quite effectively in Cases B7, B8 and B10, and of itself maintained a relatively low count in cases B3 and B5.

Orange juice, as a source of vitamin C, was given in doses of half a glassful twice daily and helped considerably to cut down the count in Case B3. It was not sufficient of itself to aid Case B8, with a total of 600,000 colonies still, at a late period. However, the administration of vitamin C, in this form, and in combination with other hygienic measures, seemed to be somewhat helpful in some cases.

The combination of a dietary composed of daily administered vegetable products, meat proteins and orange juice brought Case 9 into the negative group, and placed Cases B7 and B5 within the safety zone, with counts of 400 and 1,170 colonies per cubic centimeter of saliva.

As to the final analysis of the table: The column at the extreme right gives the final results attained in bacterial reduction. The figures obtained by the preventive measures employed are indicated in boldface type. To illustrate: The O-50 to the right in Case B8 means that by the employment of measures B, C^1, D and F, it was possible to cut down an original count of 86,000,000 colonies per cubic centimeter of saliva, to a number fluctuating between zero (negative) and fifty colonies in the same quantity of saliva. Such a low fluctuating count was maintained within the narrow limits shown provided the measures worked out for each patient, by actual bacteriologic test, were rigorously and faithfully followed. Any deviation from the prescribed régime would again bring about, in the course of a few days, a recurrence of acidophilus "overgrowth." The apparent innocuousness of an acidophilus count not above 2,000 colonies per cubic centimeter of saliva will again be briefly discussed later in this paper.

III

THE ACIDOPHILUS COLONY COUNT AS A TENTATIVE OR PRESUMPTIVE INDEX OF SUSCEPTIBILITY

In Figure 6, there is given a comparative curve showing graphically the reduction to a safe minimum of the acidophilus bacteria incidence in two groups of cases.

7. Rodriguez, F. E.: J.A.M.A., 91:708-712 (Sept. 8) 1928.

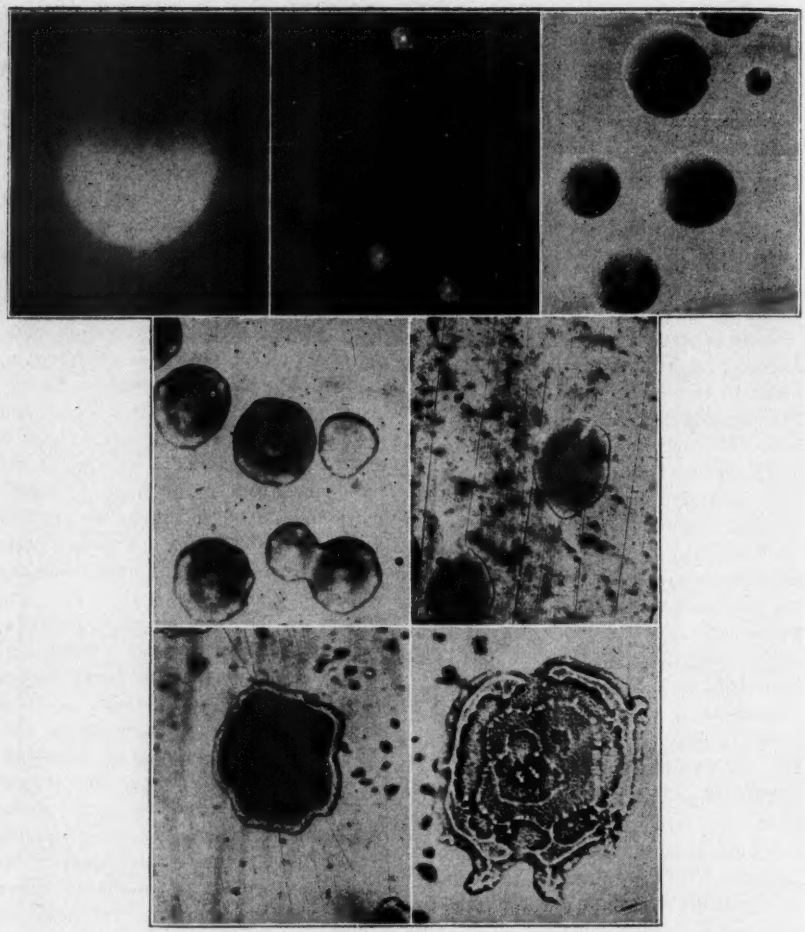

Fig. 9.—Variations in colony structure of L. acidophilus from oral sources. The type shown above, left, is highly acidogenic and represents the organism in its most aggressive form.

The main column to the left covers the data on twelve patients of various ages, all with active dental decay. The dotted curved line in the upper part of the column indicates the bacterial "overgrowth" existing at the time of examination, a curve which is quite typical of the untreated, highly susceptible patients, collectively considered. It will be observed that, with few exceptions, the counts for each patient vary considerably from the rest. For this reason, and because of the great number of bacteria per cubic centimeter of saliva, any counts of or above

1,000,000, I designate as "overgrowth," a term previously used by Bunting which I have borrowed as fitting my purposes. The lowest count obtained among these persons was 250,000 colonies per cubic centimeter, quite far from the "safety zone" of acidophilus incidence which I have tentatively placed around 2,000 colonies.

The solid curved line on the lower part of the main left column shows, individually, the rapid disappearance of the "overgrowth" and the maintenance of but a relatively insignificant count under various prescribed preventive régimes, as previously discussed in the table. Cases 9d and 10d, remaining with a count markedly above the others, deserve special mention since they introduced a factor of predisposition not considered before. In Case 9d, the patient developed a bronchial cold which kept him in bed for a large part of the period of observation. In Case 10d, the patient was the victim of an acute catarrhal conjunctivitis a few days after the beginning of observation. The prescribed preventive régimes were maintained during the course of sickness in both cases, except for minor variations in Case 9d. It is possible that the physical condition of these patients at the time may have had a bearing on the maintenance of fairly high counts.

The main column on the right of the chart depicts, also individually, the counts obtained in a series of twelve other patients in the absence of any efforts at prevention. Case 7f gave an unusually high count of over 80,000,000 colonies per cubic centimeter of saliva.

THE SALIVARY QUANTITATIVE COLONY COUNT AS A CHECK ON THE EFFECTIVENESS OF TREATMENT

The two final charts of this report (Figs. 7 and 8) establish the possibility, in my judgment, of using our knowledge of the behavior of *L. acidophilus* in the mouth as a check on the effectiveness of the treatment selected for any particular case. Figures 7 and 8 indicate that, by the combination of simple rules of prevention, most of them known since the early days of scientific dentistry, it is possible to bring about an environmental condition inimical, if not frankly antagonistic, to the overgrowth of such a dangerous acidogenic micro-organism as *L. acidophilus* has been proved to be. The ten patients observed were all within the age of high susceptibility to dental caries, as may be seen by the numbers in parentheses under the respective serial numbers.

The column on the extreme right of each case chart gives the number of carious teeth present at the time of beginning the investigation, by means of an arithmetical fractional form arbitrarily used. For example, the 2/1 pertaining to the record of Case D1 means that this patient had a total of three carious teeth of which two (above the line) had frank, open lesions, while one (under the line) had just a minute point of decay. The absence of caries is indicated by the numeral zero above or below the line, as the case may be, such as is shown at the bottom of each column. These data are recorded for periods of four months each since the beginning of the observations.

The total period of observation covers two years, during which, it may be noted, the incidence of *L. acidophilus* was kept fluctuating from zero (negative) to approximately 1,000 colonies per cubic centimeter of saliva. There were elevations of the curve at certain periods of the year, noticeably during the late summer months. There occurs to me no explanation, at present, for this variation, since all the persons under observation, with the exception of one, maintained good

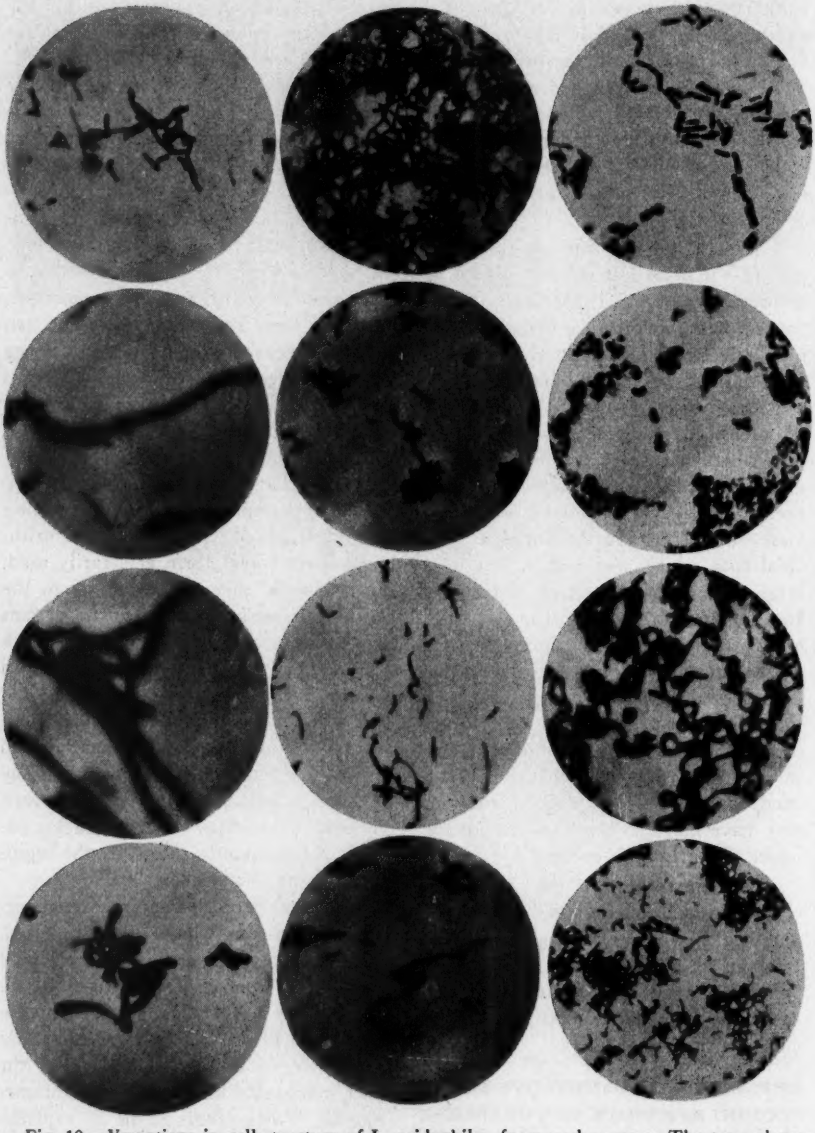

Fig. 10.—Variations in cell structure of L. acidophilus from oral sources. The type above, left, corresponds to the type of colony shown above, left, in Figure 9. Loss of type form, as shown in the other photomicrographs herewith, is accompanied by loss of acid-producing power.

health during the period of the test. The exception noted was in Case D5. The patient contracted a bad cold late in December, followed by lobar pneumonia early in January. Because of this illness, all further bacteriologic examinations were, of course, interrupted for the time being. After convalescence, the tests and treatment were again resumed, with the result shown in the chart. Exactly how high the actual overgrowth of *L. acidophilus* was during the peak of illness is not known. The high count existing at the beginning of convalescence (54,000,000) would logically lead one to surmise that it was quite notable.

COMMENT

The foregoing report is not intended as a proposed scheme of dental caries prevention. My aim has been solely to demonstrate the periodic fluctuations of *L. acidophilus* in the mouths of individuals within the age groups of high susceptibility to dental decay and the varying incidence of these micro-organisms under various influences of mouth hygiene, operative and dietary procedures. The treatment employed in these tests consists of extremely simple and known helpful means of combating tooth decay, undertaken and performed without any particular elaborateness as to measures and application.

Irrespective of whether *L. acidophilus* is the specific bacterial factor of tooth decay, a proposition which I willingly admit remains within the confines of debatable grounds, there are certain unassailable facts relating to its presence in or absence from the mouth, its biochemistry and its consistent demonstration in the carious tissues, both bacteriologically and histologically examined, that warrant the most serious consideration in any well-correlated preventive dentistry investigation. Sufficient evidence has been accumulating within recent years to justify the assumption that a marked acidophilus overgrowth in the mouth has a direct relation to the existence of tooth decay. Such established facts have been the reason for the present investigation.

It is apparent that, in the highly carious mouth, the lactobacillus is present in very large numbers both at the seat of the active lesion[3] and in the salivary fluid. Exactly the reverse of this condition, or at least a markedly decreased incidence, holds true for mouths clinically noncarious. It has been shown that, in some cases, in spite of the absence of clinical decay, small numbers of the bacilli can still be demonstrated in the salivary fluid. I am cognizant, before endeavoring to evaluate this finding, of the histopathologic experiments of recent years which tend to establish serious doubts as to the wisdom of correlating clinical findings (by the usual gross methods of clinical examination) with laboratory evidence of susceptibility to dental caries or the lack of it. The same conclusion is applicable to correlations with bacterial incidence. To be scientifically exact, such examination would, by all means, require a careful microscopic study of certain areas of high susceptibility for almost every tooth present. Such a procedure being an impossibility, the argument of those who believe in the ubiquity of this member of the mouth flora may well be met by the theoretical possibility that the recovery of these bacilli from apparently noncarious mouths should not necessarily be interpreted as an indication that they are indifferently present in all mouths, but rather that decay is present in some form undiscoverable by our present means of clinical examination.

Notwithstanding the foregoing very cogent reason, I am of the opinion that

a constantly negative mouth is the exception and that fluctuations in count may and do exist in the same person at different times, even in the absolute absence of any lesions. The range of fluctuation maintains itself within rather narrow limits from the point zero in the absence of clinical decay. In other words, there is a constantly rising and falling tide of *L. acidophilus* in the oral cavity, but the incidence is always maintained within the bounds of safety in the clinically noncarious mouth. The present close contacts of civilization and the wide distribution of this micro-organism in nature permit of no other interpretation. Furthermore, whatever the mechanism of defense in the mouth is, there are reasons to believe that it can deal effectively with slight contaminations; while it must, of necessity, be rendered helpless against a bacterial accumulation running into the tens of millions of organisms in the highly vitiated environment found in some mouths. On the other hand, the chemical nature of saliva, its constant adjustments and readjustments within well defined p_H ranges, its continual state of flux and the probable existence of bactericidal substances are conditions which necessarily antagonize the micro-organism and permit it only a very arduous existence. In consequence, it is my belief that there is a mechanism of defense, mostly physiologic, in the normal mouth capable of protection of the enamel cortex, provided the bacterial incidence does not exceed certain limits. Were it not so, dental caries would in all probability be a more rapid and destructive process than it actually is.

One of the reasons that misunderstandings have developed regarding the relation of bacteria to dental decay, even to the point of threatening the validity or soundness of the millerian theory, has been the tendency to interpret the bacterial factor of tooth decay in the same light or by the same principles as the commonly known specific microbial agents related to various infectious diseases. Infectivity, as classically conceived, is not the only determining factor in destruction in this instance. It would be the limit of folly or perhaps of ignorance to try to induce caries in the mouth of an experimental animal by the simple expedient of feeding a few million bacteria. The problem is not so superficial as that. We are dealing in this instance with a micro-organism devoid of any toxic action, in the sense that this term is employed in general medical pathology, that may find a fair degree of acclimatization in the mouth and that, if the environment is suitable, is capable of maintaining a long existence on the mucous membranes without any appreciable injury to the soft tissues of the host. Its harmfulness is limited to the hard dental tissues, and it is only harmful when no disturbing hygienic agent is present to arrest its multiplication to the point of luxuriance.

That various micro-organisms may, probably from a change in environment, undergo certain variations in cell structure and colony form (dissociation), with a consequent loss of aggressiveness is a theory that has aroused much interest on the part of medical bacteriologists. This phenomenon of bacterial dissociation or mutation has been ably and amply discussed by Hadley[8] in a recent monograph. Within the last few months, Hadley, Bunting and Delves[9] have published a most valuable study of the phenomenon of bacterial dissociation as related to *B.*

8. Hadley, Faith P.: J. Infect. Dis., 40: 1-312 (Jan.) 1927.

9. Hadley, Faith P.; Bunting, R. W., and Delves, E. A.: Recognition of Bacillus Acidophilus with Dental Caries: Preliminary Report, J.A.D.A., 17:2041-2058 (Nov.) 1930.

acidophilus of both oral and intestinal origin. Since this question of morphologic variation should be considered as another factor of importance in evaluating the relative aggressiveness of these bacteria when found in small numbers in the clinically negative mouth, I do not hesitate to mention it in this report. In Figures 9 and 10, I wish to illustrate my own observations of the mutation of *L. acidophilus* (oral type) from the normal, as a further argument for the need of newer concepts of interpretation in dental bacteriology. The views of Hadley, Bunting and Delves[9] as to the loss of acidogenic power of *L. acidophilus* in the mutation from typical to atypical variants I have confirmed in various past and recent researches.

CONCLUSIONS

1. The incidence of *L. acidophilus* in the salivary fluid of persons susceptible to dental caries can be influenced by various hygienic measures.

2. By a combination of various simple clinical, hygienic and dietary measures, it has been found possible to reduce counts of over 80,000,000 colonies per cubic centimeter of saliva to figures fluctuating between zero and only a few thousand colonies of this micro-organism.

3. The bacterial incidence has been determined by a quantitative colony count method.

4. The results obtained suggest the possibility that, by the employment of this or a similar procedure, the effectiveness or noneffectiveness of dental caries control methods may be determined.

SOME OF THE CONTRIBUTING FACTORS IN THE EVOLUTION OF DENTAL PRACTICE*

By HOMER C. BROWN, D.D.S., F.A.C.D., Columbus, Ohio

LINCOLN is often quoted as having appropriately said: "I do not think much of a man who is not wiser today than he was yesterday," and Henderson, in his book on "Education and the Larger Life," says: "It is immoral for a man to do less than his best." It is my conviction that every member of this club is in sympathy with these expressions, which express my views with reference to the duties and responsibilities of the person who is especially well qualified to render a particular service that will contribute to the benefit of mankind.

Ambition, industry and a close application to details are essentials in obtaining knowledge, a very positive factor in all substantial progress. When these favorable qualifications are supplemented with a desire to make a contribution for the benefit of the present generation, and those not yet born, the truth-seeker is greatly stimulated to concentrate his best efforts on his particular project. If he possesses high ideals and industriously applies himself in an effort to reach them, and fails, the public will sympa-

*Presented before the Torch Club, Columbus, Ohio, Oct. 16, 1930.

thize with him, but their interest will soon cease if he accepts a temporary setback as permanent failure.

A genius is a rare person, and affords a pronounced stimulus in any activity of life, but we must not overlook the fact that the outstanding achievements throughout the world have resulted from the ambition and activity of the larger group known as the "average people." Except on rare occasions, those responsible for noteworthy achievements are seldom accorded appropriate recognition until after their death. This is most unfortunate, since it is far better to give expression of appreciation to such deserving persons while they are living rather than to be stimulated, through belated sentiment after their death, to bestow encomiums in excess of that which their services really merited.

It is not so difficult to make progress with a favorable tide, while adverse currents tend to weaken our confidence, destroy our morale and reduce our speed; but as long as we continue to develop persons with the ability, ambition, confidence, poise and courage possessed by our world famed hero, Col. Charles A. Lindbergh, the country will continue to go forward in spite of the discouraging "air pockets" encountered from time to time. Incidentally, Colonel Lindbergh's maternal grandfather, Charles H. Land, of Detroit, was a dentist who was recognized as the porcelain genius of his day.

One person, or at least a limited number of persons, are usually directly responsible for initiating movements that have for their purpose the increasing of standards in every field of endeavor. Thus, such progress is generally traceable to a few who have recognized the limitations of the available knowledge of their day in the activity in which they are most interested and, at the same time, appreciated the needs, the opportunities and the possibilities for some constructive improvements. Such persons are usually classed as enthusiasts, or even fanatics; for instance, we have just recently celebrated the discovery of America by Columbus, who was considered the outstanding fanatic of his day by many of the supposedly best informed persons in his country. Yet, any interest shown in their problem tends to arouse an increased determination on their part, and they are justly entitled to the encouragement of those interested in any way in the general problem. Fortunately, such persons do not usually require so much encouragement as the average person, and they are very appreciative of any interest taken in them or their work, especially by those who should be directly concerned. Further, to thus recognize the service, ability and sacrifice of others ought to be a pleasure to anyone, which, in the end, may result in benefits to all. If such persons have a good reason to anticipate success, and later the approval of those interested in their special problem, nothing becomes too difficult or exacting for those with an investigative or research trend of mind.

The outstanding objective of those desirous of making a constructive contribution, in any field of activity, should be that of rendering the best possible service to the specific task, and, in doing this, they should be considerate of the interest and views of others, especially those who do not promptly accept all of the theories advanced. Therefore, it is futile to permit opposition, or even the adverse comments of so-called enemies, to discourage such effort; rather, this should be accepted as constructive criticism, which should tend to accelerate them; otherwise such workers may lose interest in their problem.

In discussing some of the contributing factors in the evolution of dental practice, I shall limit myself to some of the outstanding developments during the past four score and ten years, since, strictly speaking, dentistry as a profession dates from 1840, when the Baltimore College of Dental Surgery, the first dental college in the world, was established, and the first dental society, the American Society of Dental Surgeons, was organized. *The American Journal of Dental Science,* the first dental journal, was published in 1839. Horace H. Hayden, Chapin A. Harris, Henry W. Baxley and Thomas E. Bond, Jr., obtained a state charter, Feb. 1, 1840, authorizing the founding of the Baltimore College of Dental Surgery, which was opened that fall for the acceptance of students desiring to study dentistry. Drs. Hayden and Harris were dentists, and Drs. Baxley and Bond, physicians. Dr. Hayden became president of the college and Dr. Harris, the dean and also the editor of the dental journal. Both Hayden and Harris had formerly been medical students at the university, and an honorary medical degree was conferred on Dr. Hayden in March, 1840.

In 1844, Horace Wells, a dentist of Hartford, Conn., discovered the anesthetic properties of nitrous oxid gas and, in 1846, William T. G. Morton, a dentist of Boston, discovered the anesthetic properties of sulphuric ether. Both made prompt public announcement and gave clinical demonstrations of their discoveries; and I have no hesitancy in saying that, as regards afflicted humanity, these two contributions, occurring within the short period of two years, were so valuable that, in my estimation, there is nothing comparable in the history of the world. There is no contention with reference to the discovery by Dr. Wells, but there has been some question raised with reference to Dr. Morton's discovery, some contending that this credit belongs to Crawford W. Long, a physician of Jefferson, Ga. It is claimed that he employed sulphuric ether in the removal of a small tumor from the neck of one James M. Venable. The records clearly set forth the fact that Dr. Morton made public announcement of his discovery and supplemented this with clinical demonstrations, in both Boston and London, which prompts me to state that there is no question as to his being entitled to be recognized as the rightful discoverer. I say this since any discovery in science or any invention bases its claim for recognition on publication, and whatever experimenting, if any, Dr. Long may have done prior to Dr. Morton's announcement, he failed to recognize its merit until after the result of Dr. Morton's achievement had been made public.

Soon thereafter, various dental societies were organized, and a number of states enacted laws regulating the practice of dentistry. Therefore, from the impetus given it by Drs. Hayden, Harris, Wells, Morton and other dental pioneers, the dental profession, in a very brief period of time, made a most rapid and remarkable advancement. It is also worthy of note that a corresponding development took place in the manufacture of dental instruments, equipment and materials. This special industry has progressed hand in hand with dentistry, and American dentistry and dental industry are recognized as preeminent throughout the world.

It may be interesting to review some of the developments in connection with the organizing of the Baltimore College of Dental Surgery. It is true that medicine and dentistry had been practiced in

a limited way for many centuries, but it must be recognized that all such services were greatly restricted. Further, the qualifications necessary for practice were largely obtained through being "handed down" from father to son, or by a varied period of time served as an apprentice in the office of a physician or a dentist. The Medical Department of the University of Maryland was established in 1807, but the length of the courses was only a few months in the beginning and the subjects taught were quite limited.

Prior to 1840, a person who desired to qualify for the practice of dentistry could become an apprentice in the office of a dentist or take the regular course of study provided in the then existing medical colleges. In the event that the aspiring dentist took the medical course, it resulted in his spending more time in qualifying for practice than was required for the practice of medicine, as his apprenticeship in a dental office was not recognized. It was no doubt because of this handicap that some of the more progressive surgeon-dentists, as they were called in that day, were desirous of providing a college course for dentistry in connection with the medical department of the University of Maryland. Had they been supported in this constructive educational program, the probabilities are that dentistry never would have developed as a separate profession. There was a professional jealousy or enmity existing between Henry W. Baxley and William N. Baker, both physicians, which was probably the influence responsible for the rejection of the proposed plan to establish a dental course in the medical college of the university.

The second oldest dental college in the world, the Ohio College of Dental Surgery, was established in Cincinnati in 1845 by James Taylor and others. The second oldest dental journal, the *Dental Register of the West,* began its publication in Cincinnati in 1859. Reference has been made to the rapid progress immediately following the establishing of the Baltimore College of Dental Surgery, yet I think it will be generally conceded that more real and substantial advancement has been made during the last two decades than was made from 1840 to 1910. In a recent conference, William Gerry Morgan, president of the American Medical Association, stated that the dental profession had advanced a generation during the past fifteen years, certainly a strong endorsement by the distinguished ranking official of organized medicine.

It is indeed interesting to note how many outstanding events incident to the development of dentistry as a profession occurred in the first few years after the founding of the first dental college. All of these were noteworthy, and acting as a decided impetus in furthering organizational contacts which had a marked influence on the advancement of the profession; and when we consider the limited number of persons connected with its early history, we marvel at their accomplishments and we should never fail to pay tribute to them for their constructive contributions. Further, it is noteworthy to state that Dr. Hayden was in his seventy-first year when he became the leader in organizing the Baltimore College of Dental Surgery; but this was before the alleged age theory of Osler was recognized.

In reviewing the historical background of dental education, I find a record that, in 1837, Horace H. Hayden was giving dental lectures to the medical students of the University of Maryland, but it is stated that he was not listed as a member of the faculty.

It is interesting to note, especially before an Ohio audience, that many of the outstanding men in both the early and the later development of the profession were Ohio men: Drs. Miller, Taylor, Taft, Smith, Rehwinkle, Watts, Atkinson, Butler, Ebersole, Wilson, Barber, Callahan, Custer and many others who are now dead. A statue of Willoughby D. Miller was erected on the campus of the Ohio State University soon after his death, which occurred in 1907. Dr. Miller, who was born on a farm near Alexandria, Ohio, only a few miles from Columbus, and was recognized as the outstanding dental scientist of his day, developed the Miller theory of dental caries. He practiced in Berlin, Germany, for a number of years and received unusual recognition in that and other countries for his accomplishments. Dr. Miller severed his relations in Germany and had accepted the deanship of the School of Dentistry, University of Michigan, expecting to devote his time and well-known ability to the advancement of the profession in this country, but soon after returning to his former home, he was stricken with appendicitis and died shortly after an operation.

For many years, there was more or less feeling in the learned professions, as well as in the business world, that a dentist had no recognition or accredited position, and there was a general disposition on the part of the medical profession to give little consideration to the dentist or to recognize that diseases of the oral cavity could in any way be connected with or influence any general systemic diseases. The developments of the past two decades have been such as to overcome this marked indifference, and now there is a general disposition of good will and cooperation between the two professions, such as could hardly have been anticipated a quarter of a century ago. It is true that there is more or less mechanics involved in the successful practice of dentistry, but it is also true that mechanics in any profession or vocation should not be considered as a liability but rather recognized as a distinct and valuable asset.

In connection with the recognition of the close relation of the medical and dental professions in the prevention and treatment of disease, I feel justified in referring to the developments during two committee meetings, held in Chicago last week, relating to some of the work of the Committee on Public Health Administration of the White House Conference on Child Health and Protection. It was very gratifying to note the changed attitude of the physicians and health officials in recognizing the importance of the dental phase of health problems and tentatively coordinating their activities in this work, and I anticipate that the final result will be that the relations of the two professions are going to be very closely correlated.

One of the best addresses on the importance of a healthy citizenship that I ever heard was made by President Hoover at the initial conference with our full committee, held in the cabinet room, Nov. 7, 1929. In this address, the President stressed the fact that health and education were problems which should receive the same general consideration. He stated: "We already have enough knowledge which, if brought together, compared and sorted, would give us some approach to the normal child. The crux of the problem is as quickly as possible to bring what knowledge we have into the open, broadcast it and make it familiar to the average busy, but deeply concerned parent. We await from the scientific world that formula which

will enable all those who care for children, who seek a better era, to mold the boys and girls of today into stalwarts to whom we entrust our hopes for the future."

The following are some of the outstanding conditions which have largely contributed to the changes in the practice of dentistry today as compared with those in effect at the time when I entered the profession, in 1890:

1. Recognition of the necessity for increasing the standards in dental practice, by the leaders of the profession, resulted in the enactment of dental laws in the various states, which may be properly associated with the increased preliminary educational requirements of dental students for entering college, as well as the increased curriculum of such colleges, advanced from time to time in order to "keep step" with these increased requirements. In this connection, the Carnegie Foundation made an exhaustive survey, only a few years ago, which had for its purpose the developing of better dental colleges throughout the country and elimination of the private and weak institutions, thus centralizing, as far as possible, dental education in the various state universities.

2. The development of better organizations in the profession, which stimulated the interest of those in practice in improving themselves by attending various dental meetings, clinics and postgraduate courses, the best possible stimulus being thus created and an opportunity provided for them to become familiar with the recent advancements in dental practice.

For a number of years, the National Dental Association had only a limited membership and in no sense was it entitled to be considered as a representative national organization, since, from time to time, its membership only approximated from 650 to 800. At the Boston meeting in 1908, a reorganization movement was started, so that the state dental societies could become affiliated as constituents of the national organization. As corresponding secretary, I was in close contact with the subsequent developments. It was surprising to see the opposition that developed to any proposed constructive program, and it required considerable time and effort to overcome this; but this was finally consummated at the 1912 meeting, to become effective in 1913. At that time, most of the state organizations had become affiliated as constituent societies, which provided a membership of approximately 12,500, and this has increased, until today the membership of the American Dental Association, the successor of the National Dental Association, is in excess of 36,000.

3. After this reorganization, several new activities were undertaken, which was a stimulus for greater progress. At the 1913 meeting, provision was made for creating a scientific foundation and research commission, and since then the Association has expended in excess of $300,000 in various types of dental research, principally in the field of biology and chemistry. At this time, we are conducting a cooperative research program at the national Bureau of Standards, which directly relates to the materials used in practice. Most of these researches have been conducted on a cooperative basis and, in all probability, the total amount expended in dental research during this period approximated $1,000,000, since the universities and institutions receiving grants are usually required to equal or exceed the amount appropriated by our Association. Further, in connection with our work at the Bu-

reau of Standards, we have a cooperative clinical committee consisting of approximately 175 dentists throughout the country who are devoting considerable time and effort to standardize clinically certain laboratory findings of the research workers at the Bureau of Standards.

4. In 1901, Congress enacted legislation creating an Army dental corps, but the status provided was in no way attractive to professional men. With our better organized profession and a clearer conception of what was right and just, Congress, Oct. 6, 1917, enacted legislation placing the dental officers of the Army on an equal plane with the medical officers, and, the following year, similar legislation was enacted for the Navy Dental Corps. This recognition, together with the developments incident to enlistment for service during the World War, which clearly demonstrated the needs for better dental care, very greatly changed the status of the dental profession and, be it said to their credit, many prominent medical men have been leaders in an educational program having for its purpose the stressing of the importance of a closer relation between the practicing physician and the dentist, to the end that our clientele should receive the best possible treatment through a better understood and appreciated cooperative procedure. It is true that soon after attention was so generally and specifically directed to the importance of considering the mouth and teeth as possible foci of infection, there was a tendency with many members of both professions to carry this to the extreme, but the pendulum has now swung back and a more conservative practice is followed.

5. The Educational Council of the American Dental Association has made valuable contributions, from time to time, relating to the raising and standardizing of dental education.

6. For many years, the various dental organizations have spent much time and money in promoting dental health programs and the influence of these has been stimulating and far-reaching.

7. While the foregoing has treated this subject in a broad and general way, it was the influences heretofore mentioned that stimulated and made possible most of the following specific factors in the evolution of dental practice:

(*a*) Better organizations, more adequate legislation, higher educational standards and an increased interest in research problems.

(*b*) The recognized need for the sterilization of instruments and the observing of asepsis as a general procedure in practice.

(*c*) The use of cast inlays as against the former method of restoring lost tooth structure.

(*d*) The use of improved materials, medicaments, instruments and equipment; such as the roentgen rays for diagnostic purposes, and special golds and other appropriate materials to better meet the requirements of individual cases.

(*e*) The advent and recognition of special practitioners in order to render a more efficient limited service and the development of an improved technic in most phases of practice.

(*f*) The use of procain, nitrous oxid and oxygen and other anesthetics in controlling pain.

(*g*) The recognition that pulpless teeth were largely responsible for dental foci of infection, which has encouraged earlier dental treatment in order to preserve the vitality of the teeth.

(*h*) The emphasizing of better personal care and professional prophylactic

treatment as the best possible procedure in prevention.

(*i*) The recognized need for providing a legal status for dental hygenists to function in relation to the dentist in a manner similar to that in which the registered nurse functions in relation to the physician. This makes available an important limited service to a greater number, but, unfortunately, some of the dental colleges have been rather backward in providing such educational facilities.

(*j*) The research program in process of development at the present time, to better standardize the technic best adapted in certain cases of practice, which will undoubtedly result in more efficient service.

You will observe from the foregoing that I consider that the dental profession has made noteworthy contributions, as well as a rapid and substantial progress, even though every one present may be prepared to designate some definite shortcoming; which may possess much merit. Such exceptions should be made and accepted as constructive criticism with the hope that mutual benefit will result therefrom. High ideals are always essential factors in progress, but unfortunately perfection is seldom obtained.

CONCLUSION

I feel justified in stating that the status of the dental profession was never so favorable as it is today. As a general rule, dentists are better qualified to render a higher value of service and the medical profession is looking to them for greater assistance and cooperation than at any time in the past. The public is also giving more personal and professional care to their teeth, and the dentist's position in the community is better recognized. Thus, his future was never more promising and the importance of dentistry was never so great.

However, I desire to make the following specific and constructive observations:

1. In my opinion, the question of diet is one of the most important factors in developing and maintaining the highest possible standards of health, and it is quite necessary, from a tooth structure point of view, that prenatal diet, as well as the diet of children, be given the careful thought that the present-day knowledge relating to this subject would seem to demand. This, together with early personal care, supplemented by regular professional examinations and treatment, will tend to reduce dental caries and associated diseases to the minimum. Preventive medicine and dentistry should be given far more attention in the future than it has received in the past, as it is far better to prevent disease than to cure it.

2. The importance of prevention should be strongly emphasized in both the medical and the dental colleges, as well as in the schools for nurses and teachers; and in addition to direct personal instruction by the physicians and dentists to their clientele, which is necessarily limited, it should be recognized as both ethical and practical to make use of the platform, the magazine, the press, the radio and the motion picture to present constructive educational health programs, approved by some well recognized authority, to assist in developing a healthier and more contented and efficient citizenship.

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BUILDING AND MAINTAINING A SUCCESSFUL DENTAL PRACTICE*

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THE fundamentals for acquiring and holding a successful dental practice are very simple and might be enumerated in a single sentence, but the daily details are so infinitely varied that they cannot be written in an entire paper or even in one book. The best we can do is to touch, in the most fragmentary way, on certain of the essentials, and, in doing this, we must of necessity repeat many of the things that have already been said on the subject, and we must also treat our topic in more or less of a kindergarten fashion. That this is necessary will become apparent when we recall the fact that, with many of our members, the process of practice building has not yet progressed beyond the kindergarten stage, and one difficulty in writing a paper on this topic relates to the fact that the needs of the listeners are so varied that they cannot all be met by the same kind of advice. In certain respects, therefore, it will be necessary to generalize more than would seem on the surface to be desirable, while, in others, the treatment will be as specific and concrete as it can be made.

The first requisite in building a practice is, of course, to get patients, and the next requisite is to keep these patients and so treat them that they will send other patients to us. This may seem like a blank generalization, and yet it is really the most concrete of all our problems. I am not addressing myself to a recent graduate, whose primary problem concerns itself with securing his first patient. Every member of this organization has at least a few patients, and it is to the management of these that he must devote his undivided attention. A rule of every office should be that no patient should ever be permitted to leave the office without being imbued with the impulse to send other patients to that office for service. The recommendation of patients who have received attention at your hands is the most effective advertising a practitioner can have, and there is no other means by which a profitable practice may so certainly be secured. The thing that really counts is what the patient says of you to others after he has left your office and is mingling with his friends in the ordinary walks of life, and he will assuredly talk to others on the basis of the impression you have made on him. I would advise every young man or woman practicing dentistry to nurse that practice most assiduously till you have brought to your support an overabundance of good loyal patients.

Then, the problem is yours of so managing these patients that they will cooperate with you in making your practice a profitable one. As far as economics is concerned, it matters little how many or how few patients you serve unless you

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can make from their service an adequate return to give you a substantial balance in your favor at the end of each year. Speaking in an economic sense, there is little to be gained by giving all the energy you possess to the service of your patients and not reaping a sufficient financial return to recompense you properly. You may get a professional thrill and glow from such service (and I am not minimizing the satisfaction to be gained from that), but this does not make provision for the proverbial rainy day which is supposed to overtake all of us sooner or later.

And it may be said with all confidence that, in this land of North America, the average financial status of the class of people who apply for dental service is such that a dentist may receive from them without protest or equivocation a remuneration ample to make him independent in his old age, provided he uses the proper intelligence in handling them. The theory that the people of this country cannot pay good dental fees is discounted by the outstanding fact that every business day of the year, they spend enormous sums on trivialities which merely tickle their fancy and appeal to their vanity. They must be taught greater respect for the value of dental service, and they will never be taught this until dentists themselves assume a greater respect for their own service. On every legitimate occasion and without obtrusion, the value of our service should be impressed on the people till they are willing to reward the dentist adequately without demurring.

To speak more specifically: one of the prime requisites for building a successful dental practice is basic honesty on the part of the practitioner. This may be a trite statement, but it is fundamentally true and thus its constant repetition is never out of place. One of the most inconceivable things to me in all human relations is the assumption on the part of the dishonest professional man that he can succeed in "getting away with it" for an extended period. He never has and he never will. If he seems to succeed by shady methods, it is only seeming, and the inevitable day of reckoning comes as surely as fate. There is no other barrier to substantial success so certain and so inevitable as dishonesty of purpose, and it has proved the downfall of many a promising professional man. Establish your career on the basis of rockribbed honesty and you are more than halfway on the road to success.

But honesty is not by any means all that is needed in building a practice. Personal attributes in a calling with such intimate relations as dentistry go a very long way toward making or marring a man's career. In this respect, it is not only the big things that count: it is also the little things. Many a man has lost patients that he really wanted to keep by carelessness with his finger nails, or by dropping an inlay on the floor and returning it to the mouth without letting the patient see that he has carefully cleaned it, or by being called to the telephone and going back to his operating without washing his hands. People are developing a cleanliness consciousness about such matters, and they do not relish having in their mouths fingers that have raised a window or have touched any of the ordinary objects around the room. It may be said that some of them carry their prejudices to a foolish extreme, but it is often the foolish patient who is a profitable one, and the practitioner who aims to succeed must endeavor to attract and hold all classes of patients, not merely the apparently desirable ones. If there is any one cardinal

virtue in conducting a dental practice, it is that of the most scrupulous and constant cleanliness, and without this, no man in the present age may expect to succeed.

One of the requirements for success in practice is to be a student of human nature. Without stopping to analyze what a psychologist is, you must be a psychologist; that is, you must acquire an intimate knowledge of the varying temperaments of the people who come under your care. You can no more treat all people alike and obtain the same reaction from them than you can rely on having the same kind of weather each day in the entire year, and the dentist who cannot adapt his methods to the peculiarities and points of view of the varying types of humanity who come to him cannot expect to travel very far on the road to success. The ability to take advantage of the peculiarities of people and to turn each oddity into an asset of good will is accountable for much material success in any occupation in which one is constantly dealing with the human equation.

With some individuals, a running conversation during an operation is a source of comfort, and tends to relieve the tension; but, with others, the less said, the better. The active business man whose time is important wants his work done with the greatest expedition and with no waste of time. With him the minutes count, and much conversation is out of place. An intimate knowledge of the varying temperaments of people is so important that it is well worth while to make some study of it and be able to apply it in practice. In fact, it becomes necessary to do this if one is to carry out the injunction already given to treat each individual in such a manner that he will wish to send others to you.

In line with the admonition to conserve your patient's time comes the equally important one of conserving your own. A profitable dental practice cannot be conducted without making the minutes count, and there is altogether too much waste motion in the average practice. The basis of time-conservation is efficiency and precision of technic; the training to know precisely what to do and the most expeditious manner of doing it. Many a man changes an otherwise profitable hour into an unprofitable one by fumbling for instruments. While system in an office may be carried so far that it becomes a species of slavery and is really discommoding in itself, to attempt to work without system is not conversive to any kind of profitable achievement. Plan your work in advance as much as possible, and aim to accomplish something worth while in each half hour or hour of your time. It is astonishing what can be done for a patient in thirty minutes provided the work is planned and systematized; and there is really less tension on the operator in a rapid and expeditious execution of the operation than there is when there is too much puttering, with its consequent lack of accomplishment. A sense of having done something substantial for a patient at each sitting is wonderfully satisfying as it also adds materially to the legitimate profits of the day.

And this brings up at once the consideration of compensation for our services, a question that enters more prominently into our economic problems than any other. At least, it is a question that seems to loom larger on the economic horizon of dentistry, and that enters more prominently into all of our deliberations on the subject, than any other. Let us study this with some care. As I observe the common tendencies of the

day in any consideration of this subject, I cannot but feel that the point of view of many of our men, and I may say in particular of many of our young men, has been somewhat vitiated by the false teaching that has gone out. In all of the extended discussions of this subject that I have read and to which I have listened, the burden of the argument is for the most part one-sided. I have seen emphasized repeatedly the point of view of the practitioner, but I have heard very meager mention of the point of view of the patient. In any recent consideration of the subject, as far as I have been able to observe, the patient has never been given his "day in court." And this attitude on the part of our dental economists I do not believe to be either right or economically profitable. I have said elsewhere, and I now venture to repeat, that "no system of dental economics can ever be permanently successful that fails to take into account the welfare of every party to every transaction." If that is not at the same time good ethics and good economics, I yield my claims to knowing anything of either.

Selfishness of any kind is not only deplorable, but is also so fundamentally wrong that it usually defeats its own end, and selfishness in dentistry is no different from selfishness in other walks of life, except that selfishness in professional life is more deplorable and more surely fatal than in other occupations.

In all of this, there is no implication that dentists are not entitled to adequate compensation for their services. The toll that is taken of the physical and nervous forces of the practicing dentist is of such a character that he should be well rewarded by ample fees, by fees that will enable him to discharge all of his domestic and civic obligations with ease and promptness and leave enough to enable him to set aside each year a substantial sum for his maintenance in his declining days.

Probably the first question of the young practitioner is: "How am I to obtain fees that will enable me to do all of this and still leave my patients satisfied?" To answer that question in detail would involve an extended and intimate study of the various economic factors entering into it, which at this time is beyond our scope; but I may summarize by saying that before any professional man can exact from his patients a just fee for his service, he must first have the conviction in his own mind that his service is worthy of a good fee, and, in the next place, his demeanor must be such that his patient is also convinced that the fee is legitimate. This does not mean that he must constantly be harping on the subject of fees or indulging in service-selling talks. A frank discussion of fees is sometimes necessary, but to be constantly talking of fees to patients soon gives them the impression that the chief interest of the practitioner is the fee rather than the service. And the moment a patient gets that impression of a dentist, the fine and loyal relationship that should exist between them is at an end. No man can demand adequate fees and obtain them year in and out without having the conviction in his own heart that he is entitled to them. And if he has that conviction, his patients will soon sense it without frequent discussion of the subject. In fact, to be always harping on fees is belittling and demoralizing, and it at once stamps the practitioner as mercenary. A frank understanding with the patient as to the customary fees of the operator is all that is necessary, and from that time forward, there is nothing to be gained by frequent reference to the subject.

I sometimes think that the constant struggle of some men to exact large fees would result more profitably to them if they spent this energy in a greater amount of service at a more equitable fee. It has been my observation that the men who have exacted the largest fees are not the men who have succeeded most in a financial way or have made the best provision for old age. The economic regeneration of our profession will come more surely through increased efficiency and a just conservation of time than it will through higher fees. Industry will prove a greater asset in building and holding a practice and establishing a creditable bank balance than will the ability to exact unusually large fees.

There is one solution of the fee question that I commend to all of those who are having trouble with it. As I have just intimated, a constant discussion of this subject on the part of the operator is highly objectionable from every point of view, and the suggestion I make is to have someone else conduct whatever discussion is necessary. By this, I mean that every dentist should employ a young lady assistant as early in his practice as possible, and one of her first duties should be to take charge of his bookkeeping and attend to his accounts. She should be trained carefully in the management of the business end of the office and become thoroughly familiar with her employer's fees, and it should be her duty to adjust any differences of opinion that may arise over fees or other business matters. A well-trained girl can handle such affairs better than the dentist himself. She has more tact and a quicker wit, and can say things on his behalf that he could never venture to say for himself. This leaves him free to devote all of his energies to the task of taking the best professional care of his patients, all of which tends to greater smoothness in the office and more efficiency of service. A good assistant will pay for herself many times over, not only in actual money, but also in the relief of tension and the freedom from distraction and annoyance she assures her employer.

At frequent intervals — every month, or at most every three months—a careful check-up should be made of the economic situation in the office. The dentist should know not only how he stands financially, but also the general drift of his affairs. He and his assistant should consult about his collections and other matters connected with the business end of his practice, and if things are not progressing satisfactorily, he should seek the cause and remedy it at once. Slip-shod methods have no more place in a professional pursuit than in any walk of life, and the dentist should not allow his interests to drift along without careful supervision.

It would sometimes seem to be about as difficult to maintain a successful practice as it is to build one, and many a prosperous man has lost ground by being too independent or indifferent. The most dangerous time in the history of the individual or the community or the nation is when the impression becomes general that the acme of success or attainment has been reached and there is no further incentive for intense application or for industry. From the moment a dentist assumes that he has reached the pinnacle and that there is no need for him to make an especial effort to nurse his practice, he at once begins to lose his footing and to slip. A certain amount of confidence is necessary, but overconfidence is fatal and the man who takes it for granted that he no longer needs to cater to the tastes or even the whims of his patients has already started on the downward road to

the point in his career when he will have no patients.

It is well, without braggadocio, to foster an air of prosperity and success at all times. No one wants to deal in any way with a failure, and one of the greatest handicaps to the building and maintenance of a prosperous practice is the display of pessimism or grouchiness. Time was when a certain amount of individual peculiarity in a dentist would be condoned by loyal patients and met with a spirit of amused tolerance, but in the heave and throw of a keener competition today, the people will no longer wink at demeanor which is in any degree objectionable. They must have their dental service administered to them in as pleasant a manner as possible, and a disagreeable attitude of any kind will soon drive them to another practitioner.

There is one tendency among professional men which has frequently limited their material success, and that is narrowness of vision. To be obliged continually to concentrate on the small things of life as a dentist does in following the minute technic of his work has a narrowing influence on his outlook unless he makes it a special point to broaden out and get a grasp of the larger interests of life. The successful professional man must make something of a study of affairs outside of his calling, and be able to discuss intelligently the greater issues of national and international policies. He must recognize the fact that, in the great throb and beat of human affairs today, every intelligent individual should have something of a grasp on what is going on in the outside world.

It may be true that a pinhead cavity in a tooth becomes an important consideration in the ultimate saving or loss of that tooth, but the man who can think of nothing but pinhead cavities in teeth is getting the most out of neither his practice nor life itself. The interests of every one of us are becoming more and ever more intricately woven together, and we can no longer legitimately raise the question as to whether or not we are our brother's keeper. In a very concrete and intimate sense, we are our brother's keeper, and if we are to take our allotted place in the sun, we, as intelligent and broadminded professional men and women, must recognize our obligations outside the four walls of our offices.

And I may say that more and more the members of the profession are doing that very thing. While our topic today deals at least incidentally with the subject of economics, I wish to pause long enough to say a word on behalf of the advancement of our profession in this regard. We hear so much about the poverty-stricken condition of dentists that it is high time that we investigate the facts in the case. It is true that many of them are not living up to their legitimate possibilities in an economic sense, but the hue and cry regarding the poverty of dentists is not by any means justified. It is my good fortune to go from one end of this country to another and I mingle constantly with dentists. One of the most impressive things that I have noticed is the great improvement in the economic condition of the members of our profession in the past few decades. It was not so long ago that the economic horizon of dentists was exceedingly limited in extent and justified the impression that dentists were not successful in a financial way, but today the percentage of poor dentists is by no means as great as it was and the evidence of improvement is apparent on all sides. Today, in the country towns, it is the rule that dentists own their own homes, and many of these homes are really luxurious. I see few dentists who

do not drive their own automobiles, and while I, of course, do not know how many of them are paid for, I can well imagine that the percentage of mortgaged automobiles is no greater among dentists than among other classes of automobile owners.

I will not pause long enough at this point to enlarge on my impression of any man who drives a mortgaged car unless under mitigating circumstances, because that is another story, but I cannot but feel that the deferred payment plan in any commodity such as automobiles, while it may lead to a vastly increased output, is demoralizing in effect and a distinct handicap to the peace of mind of the purchaser. Mortgaging the future is not my idea of sound financial progress, and while I am by nature an optimist, I cannot but feel that if this practice is carried much farther, it will not be long before the chickens will come home to roost and the stack of cards will tumble about the heads of both seller and purchaser. Deferred payments always mean increased cost to the purchaser, and a handicap to the plan of building a sound investment reserve.

But the main fact that I wish to emphasize at this time is that dentists are advancing economically in common with other classes of people, and it will do none of us any good to be continually crying poverty, and to be constantly clamoring for some economic panacea to help us out of our difficulties.

Of this one thing we may be assured: we shall never improve our economic status by following some cut-and-dried policy figured out with pencil and paper by any man or body of men. Your economic problem and mine is largely our individual problem, and we might as well face the fact that no one is going to solve it for us. We may accept suggestions from others as to the systematic management of our affairs, but any tangible and lasting reform that is made must be made by ourselves and on our own initiative. We cannot shirk our individual responsibility in this regard any more than we can expect some one else to perform our operations for us and profit by it. The sooner every one of our members faces this fact and acts on it, the sooner will our economic status improve, and the sooner shall we be known as a profession having some economic acumen. If we continue to rely on some one else to solve our problems for us, they will never be solved. Let each member of our organization take this lesson home to himself, and the moment this is done, half of our economic dilemma will disappear.

Frankly, I have feared at times that so much agitation of the economic question might react unfavorably for us. The moment that the impression prevails that we are concentrating too much on the financial phase of our affairs, the public is likely to misconstrue our motives and question our professional sincerity. That there are other considerations in professional life than the facts of finance must be emphasized at all times, and we can no more afford to be narrow in money matters than we can in the principles of practice or in our outlook on affairs in general. Breadth of vision is needed here as in all our activities, and we shall never enter into our destined heritage till we have learned this fundamental lesson.

One of the essentials of a well-rounded professional career is a study of current and classic literature. The deep and abiding interests of life have less to do with a consideration of stocks and bonds than they do with the heart-beat of humanity, and while this age is of necessity a material one, and while we are compelled in a study such as we are making at this time

to take cognizance of the hard facts of finance and barter, the essence of a successful professional life involves other things than money, and other things than position and prestige in the world. It involves a mental and cultural development without which there can be no happiness in the true sense, and no success worthy of the name. Success does not mean merely the piling up of a few more dollars. It means, in addition to the accumulation of money, the acquirement of a breadth of vision that enables one to enter sanely and sympathetically into the intimate problems of life—the life of one's fellowmen as well as one's own.

The moment we begin bartering our professional birthright for a mess of financial pottage, we begin to throw away the most precious pearl of our profession. We do not live by bread alone, and what shall it profit a man if he gains the whole world of his material wants and loses the soul of his higher and more ethical aspirations? After all, the thing that really counts in professional life, the thing that contributes most concretely and certainly to ultimate satisfaction and happiness, is not so much the number of dollars that we have gathered, but the reflection of that sanctified service by virtue of which we have added to the sum total of human welfare and human happiness.

Let us conserve carefully our material interests, as in this latter day we must; but let us not sink our souls in the mire of materialism to the exclusion of those finer aspirations of life which in the end bring to us the most exalted satisfaction and the most certain solace.

MORPHOLOGY OF THE FACE, JAWS AND DENTITION IN CLASS THREE MALOCCLUSION OF THE TEETH*

By MILO HELLMAN, New York City

IN orthodontia, as in other fields of endeavor, there are two prevailing aspects of the problems dealt with, the practical and the theoretical. The practical aspect is concerned with the technic in orthodontic procedure. The successful results obtained by orthodontic treatment attest the fact that the principles involved in the technic of moving teeth are sound and well founded. Every orthodontist is quite convinced of this and, as a matter of course, he is concerned more about the number of cases he is to treat than about the problems that they present.

The other aspect is concerned with the nature of the phenomenon appearing in the form of malocclusion of the teeth. What is it? Why does it happen? And how does it come about? The available answers to these questions are, to be sure, plentiful, but because they are not quite satisfying, they spur one on to search for better ones. This contribution, therefore, is just an account of an adventure in the search for a better explanation of what is really meant by Class III malocclusion of the teeth. In view of the vague ideas prevalent in orthodontia, it appears that

*Read before the Section on Orthodontia at the Midwinter Clinic of the Chicago Dental Society, Feb. 3, 1931.

the concept of this, as well as of other types of malocclusion, is not quite clear and that a better understanding of the matter would be a distinct advantage. For instance, are we quite certain about the sort of picture appearing in our minds when reference is made to Class III malocclusion of the teeth? What form does this picture assume? And how can this form be appraised?

Our present knowledge of malocclusion of the teeth in general and that of Class III in particular is derived in the main from the teachings of Edward H. Angle.[1] Angle, perhaps more than anyone else, merits the distinction of having brought order out of chaos by simplifying the classification of malocclusion. From him, we all have learned that "All cases of malocclusion fall naturally into a very few distinct and easily recognized groups, or three great classes with their divisions and subdivisions." ("Malocclusion of the Teeth," p. 35.) It has also become common knowledge that "these classes are based on the mesiodistal relations of the teeth, dental arches, and jaws, which depend primarily upon the positions mesiodistally assumed by the first permanent molars on their erupting and locking" (p. 35). Of course, the original basis for Angle's classification, as explained on page 7 of his work, is the fact that "the first permanent molars are not only the most constant in the time of taking their positions but by far the most constant in taking their normal positions." Of particular interest in this respect is the statement that "the effect of malocclusion upon the facial lines is always to disturb their balance and harmony, and this in direct proportion to the extent of the malocclusion" (p. 44). As far as the

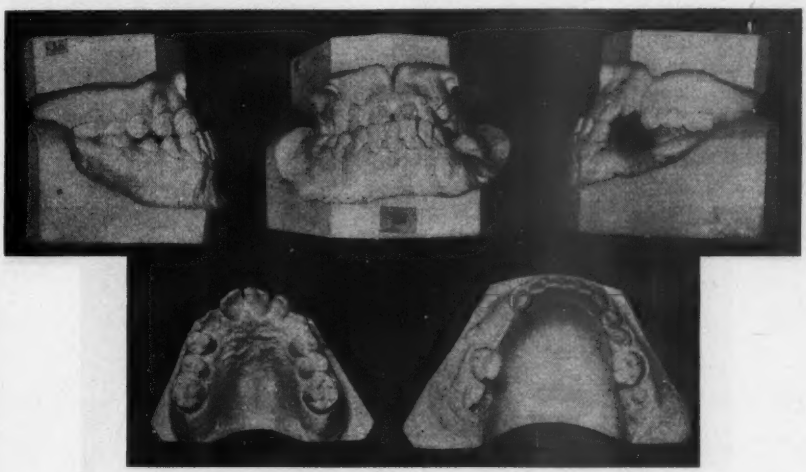


Fig. 1.—Casts of dentition in Class I malocclusion, showing characteristic form and position of dental arches and their relationship to each other. The occlusal view of upper dental arch, illustrates the diminished size and lack of room for upper right cuspid. The vertical anterior curve of the lower alveolar process and the slant in the upper alveolar process may be noted.

1. Angle, E. H.: Treatment of Malocclusion of Teeth, Ed. 7, Philadelphia: S. S. White Dental Mfg. Co., 1907.

problem in Class III is concerned, Angle defines it as follows:

> **Class III, Division 1, is characterized by mesial occlusion in both lateral halves of the dental arches. The extent to which the mesial occlusion must exist in order to place the case in the division of this class is slightly more than one-half the width of a single cusp on each side [p. 52] . . . . But in cases that have been allowed to develop—and these cases are always progressive—the mesial occlusion becomes greater, even to the full width of a molar or more.**

The effect on the face brought about by this form of malocclusion, as given by Angle, is rather general and vague. Says Angle, "In this class [Class III], the marring of the facial lines is more noticeable and unpleasing than in either of the other classes, in advanced cases amounting to a striking deformity" (p. 53). Of course, the standard by which Angle judges the marring of the facial lines is derived from his "law" which determines the proper "balance of feature." "It is that the best balance, the best harmony, the best proportions of the mouth in its relations to the other features require that there shall be *the full complement of teeth, and that each tooth shall be made to occupy its normal position—normal occlusion*" (p. 63).

Martin Dewey[2] too, in his "Practical Orthodontia," agrees with Angle, but he uses words in addition to the symbols for the different classes. Thus, on page 63, he explains that "Mesiocclusion, or Class 3, cases are those that are characterized by the mesial relation of the lower arch to the upper arch the width of one premolar." On page 75, he illustrates by Figure 73-B, which represents a face with the dentition in Class III, and says

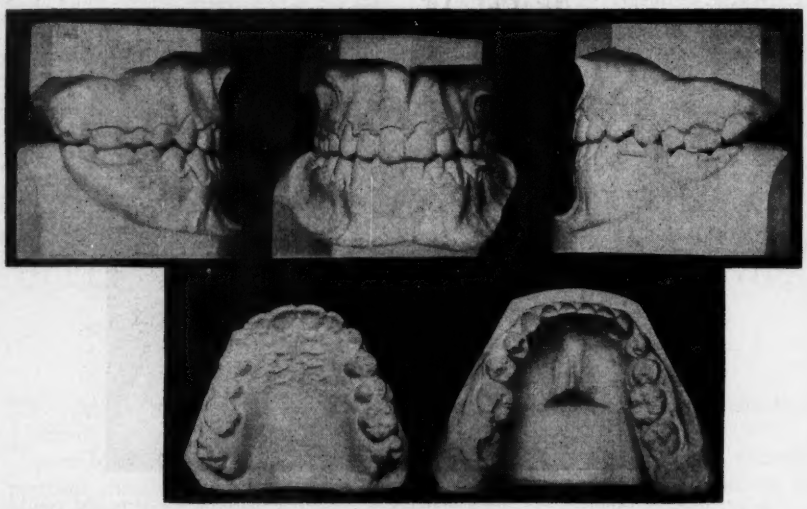


Fig. 2.—Casts of dentition in Figure 1, after orthodontic treatment; showing increase in size of upper dental arch and readjustment in relative positions of both dental arches. The slant in the upper alveolar process has been overcome, but the curve in the lower persists.

2. Dewey, Martin: Practical Orthodontia, Ed. 4, St. Louis: C. V. Mosby Co., 1919.

that "the profile shows the overdevelopment of the mandible very plainly." Much more of the literature could be cited on this interesting problem, but the foregoing are good examples of existing theories. Proof of their accuracy is entirely wanting.

After the successful treatment of a number of Class III cases, I became impressed with the fact that, although the normal in occlusion of teeth was attained, there is something about the face, jaws, alveolar arches and the positions of the individual teeth which is not quite what we were led to consider normal. For instance, the facial aspect of the alveolar process in the region of the lower incisor and cuspid teeth remains vertically convex, instead of concave, even after treatment. In the upper incisor and cuspid region, the alveolar arch before treatment is much more oblique or slanting than in the normal or in other forms of malocclusion, but undergoes marked changes during treatment. Figure 1 shows the casts of a case of this sort before treatment. The reduced size of the upper and the contrasting large size of the lower alveolar and dental arches are evident. Figure 2 shows the casts of the same case, illustrating the result of orthodontic treatment. That the success of this case was assured may be gathered from the casts shown in Figure 3, two years after all the appliances were discarded. It may also be mentioned at this point that the patient was examined again thirteen years later and the occlusion was found approximately as shown in Figure 3.

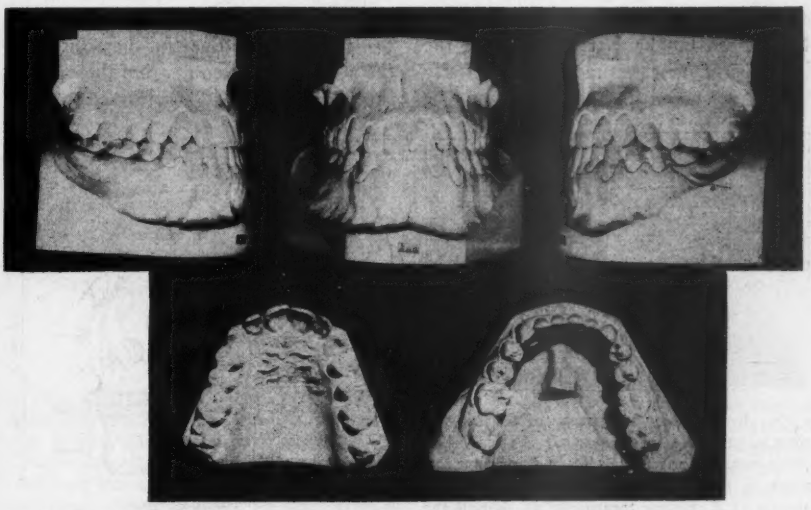


Fig. 3.—Casts of dentition in Figure 1, two years after all appliances had been discarded; showing retention of occlusion.

After a careful analysis of the case, as well as of the method of treatment, I was rather dubious as to what really happened to make the differences noted. What I really did with the orthodontic appliances was to increase the size of the upper alveolar arch to the extent of the

space necessary to accommodate the upper right cuspid and to shift the dental arches anteroposteriorly to establish the normal relationship between the upper and lower teeth. This being accomplished, I was still puzzled as to whether the lower teeth moved distally or the upper teeth moved mesially. Judging from the effect on the face, it appears that the upper alveolar arch and teeth moved forward. This can be seen quite clearly by the difference in the subnasal region when *A,* Figure 4, is compared with *B.* But this was counter to expectation, because I had been taught that in Class III the lower permanent first molars are mesially to the upper and in treatment should be moved distally. I was beginning to ask whether this was an assumption or a fact. What proof was there on either side? Can there be no alternative? Is it not just as possible for the upper teeth to be situated distally to the lower as for the lower to be mesially to the upper? I was baffled. I nevertheless kept on treating cases and obtained very gratifying results.

Fig. 4.—Profile photographs of face of patient in case shown in Figures 1, 2 and 3. The prominence of the upper lip in *B,* after treatment, is marked, when compared with that shown at *A,* before treatment, as though the upper dental arch moved forward in its relation to the lower.

It was only after many years of intensive study that I began to note certain things. The entire matter of occlusion and malocclusion began to assume a different aspect after the examination of extensive collections of skulls with magnificent dentitions at the American Museum of Natural History in New York, at the U. S. National Museum in Washington, D. C., and at the Hamann Museum, Western Reserve University, Cleveland. Not only does the occlusion of the teeth in the skulls in Class III cases appear to be different, but also the entire shape of the face, the way it is suspended from the brain case, the texture of the bones, the form of the key ridge and the position of the alveoli are different from those in the skulls with normal occlusion or with other forms of malocclusion. The facial plate of the maxillary bone, for example, is usually very much attenuated; the key ridge is sharp, instead of rounded; the facial wall of the antrum anterior to the key ridge is often deeply concave, instead of flat or convex, and the alveoli bulge out facially more than in the jaw bones of other skulls. Also deficiencies such as reductions in size and number of teeth are usually noticed in cases of this type.

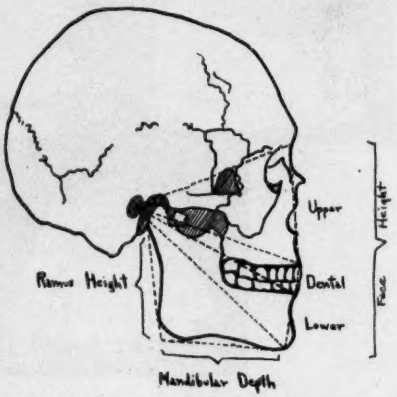


Fig. 5.—Method of obtaining diagram of facial profile.

These appear in the upper jaw more often than in the lower. It occurred to me, then, that, after all, there may be a possibility that we are looking either at the wrong picture or at the right one from the wrong angle. My researches seemed to confirm these suspicions. Thus, intensive studies and careful measurements of the faces of many skulls revealed the fact that there are no two

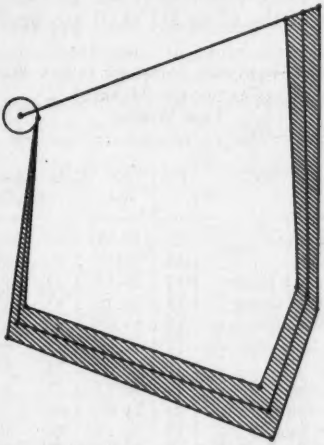


Fig. 6.—Profile outline of face of adult American Indian males obtained from average and standard deviation of measurements. The middle line indicates the average and end lines the standard deviation; illustrating the range of variability of the dimensions of the faces with dentitions in normal occlusion.

which are exactly alike. In closely related groups, the individual skulls differ less from one another than from the skulls of other groups. For instance, the faces of whites differ decidedly from those of blacks. Moreover, within the group, either the white or the black, the skulls differ less when they are of the same sex than when they belong to the opposite sexes. It then occurred to me that, if similar comparisons were made among the skulls of each sex in a certain group on the basis of occlusion of the teeth, differences might appear which would be indicative of malocclusion.

The measurements decided on refer to height, width and depth of face. The angles of different bones and of the face at different regions, as well as the position of the face in relation to the cranium, were also taken into account. The method of taking these measurements was out-

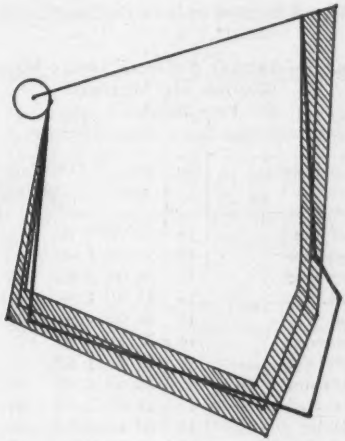


Fig. 7.—Diagram of facial profile, showing comparison between average with its standard deviation (shaded area) of facial dimensions of eighteen ancient American Indian males *(AMNH)* with normal occlusion and of skull No. 99/8307 (solid heavy line) with Class III malocclusion.

lined in contributions on this subject made some time ago.[3] Calculations of

3. Hellman, Milo: Preliminary Study in Development as it Affects Human Face, Dent. Cosmos, 69:250 (March) 1927: Changes in Human Face Brought About by Development, Internat. J. Orthodon., 22:475 (June) 1927; Face and Occlusion of Teeth in Man, ibid., 13:923 (Nov.) 1927; Face and Teeth of Man, J. Dent. Res., 9:179 (April) 1929; Face and Teeth at Adolescence, unpublished data; Development of the Face, Jaws and Dentition, unpublished data.

the measurements were made so that the average and standard deviation could be used as a "yardstick." Tables 1-5 give the kind and number of measurements secured, their average and the standard deviation. The skulls whose measurements are given in these tables were from a tribe of ancient American Indians at the American Museum of Natural History. The first column gives the number of specimens, which is rather small but was used because of the story it tells; the second column gives the average, and the third the standard deviation. If these figures are used as a standard and it is desired to find out how a skull with the dentition in malocclusion will differ from it, a comparison of the measurements will show it plainly. Thus, in column 4, the measurements of a skull with Class III malocclusion are recorded. The signs + and — indicate that the measurement of the skull with malocclusion is either greater or less than the range of variability of the normal. Thus, it will be seen that the only differences in height between the Class III skull and the standard are in the dental and nasal regions, which are less in the Class III skull. The subnasal region, or the upper alveolar process, and the ascending ramus at the coronoid process, on the other hand, are greater than the standard. The palate is narrower and the orbits are farther apart in the Class III skull than in the standard. Anteroposteriorly, the dimensions of the Class III skull are smaller in the palate process of the palate bone and larger in the entire mandible, particularly in the body of the mandible and the lower alveolar arch. The facial angle is more acute and the mandibular angle more obtuse in the Class III skull. The distance from the earhole to the most anterior point on the lower alveolar border and to the chin is greater.

From these measurements, it appears that the mandible is not only larger, but is also in a considerably more forward position in the Class III skull than in the other skulls. This is sufficient proof that, in Class III, the lower dental and alve-

TABLE 1.—ANCIENT AMERICAN INDIAN MALES (CANYON DEL MUERTO).
Face Heights

Height	No.	Average	S.D.*	Class 3 99/8307
Total face	13	116.90	9.70	116
Upper face	17	72.05	5.00	70
Lower face	15	34.00	3.45	35
Dental	13	13.31	1.38	−11†
Nasal	18	48.90	4.80	−42
Subnasal	16	22.11	3.06	+28
Palate	17	14.41	1.57	14
Post. nares	15	26.60	1.95	26
Molar region	15	29.67	2.33	31
Condylar	15	60.41	4.65	65
Coronoid	15	62.41	5.88	+70
Sigmoid notch	15	12.80	1.33	13

*Standard deviation.

†+, greater than range of variability; —, less than range of variability.

TABLE 2.—ANCIENT AMERICAN INDIAN MALES (CANYON DEL MUERTO).
Face Widths

Width	No.	Average	S. D.	Class 3 99/8307
Bizygomatic	17	129.54	6.03	127
Bimalar	18	98.60	5.50	101
Between cuspids upper	17	39.87	2.22	40
Between cuspids lower	15	35.20	2.85	37
Alveolar arch, upper	15	63.93	2.46	63
Alveolar arch, lower.	15	69.60	4.11	68
Nasal	18	26.00	1.73	27
Post. nares	16	30.82	2.25	30
Interorbital	20	21.80	1.86	+25
Palate (max.)	17	42.53	1.98	−40
Palate (min.)	17	27.29	1.77	26
Bicondylar	14	115.35	4.80	112
Bigonial	14	94.65	5.15	90

olar arches are more anterior than in the normal and that the lower teeth are mesially to the upper, the upper, of course, being equal in position to the normal. But the matter is not quite so simple.

In Tables 6-10, the first three columns show the results worked out from the measurements of forty-two European white male skulls at the Hamann Museum, Western Reserve University. It should be mentioned that all of these skulls had a full complement of teeth in normal occlusion. In addition to the columns furnishing the standard for comparison, there are three other columns. Thus, columns 4, 5 and 6 record the measurements of three skulls with the dentition in Class III malocclusion. A careful study of these tables will reveal the fact that, while all three Class III skulls differ in certain respects from the standard of the normal, each one of them also differs considerably from the other two. If the meaning of these differences is understood, it will become clear that there are a variety of forms in which Class III malocclusion manifests itself. Many more such tables were worked out in the study of this problem. Similar statistical analyses were made of skulls belonging to several other racial groups, such as American negroes, West African negroes and recent and ancient European whites from Hungary. The last three groups belong to the famous von Luschan collection at the American Museum of Natural History. The results showed that while the faces of one group differ in many respects from those of the other, the faces with Class III malocclusion show like differences from the standard in all of these groups.

TABLE 3.—ANCIENT AMERICAN INDIAN MALES (CANYON DEL MUERTO)
Face Depths
(Anteroposterior Dimensions)

Depth	No.	Average	S. D.	Class 3 99/8307
Total palate	15	45.19	4.02	42
Anterior palate	16	35.14	2.79	36
Posterior palate	15	10.59	3.78	−6
Alveoloramus	14	82.50	4.35	+88
Preramus	14	49.42	3.66	53
Ramus	14	33.32	2.94	34
Basal	15	79.39	5.01	+88
Alveolar arch, upper	16	48.69	2.91	46
Alveolar arch, lower	15	50.99	3.42	+56

TABLE 4.—ANCIENT AMERICAN INDIAN MALES (CANYON DEL MUERTO)
Face Angles

Angle	No.	Average	S. D.	Class 3 99/8307
Facial	16	84.86	2.34	−80
Alveolar	16	62.20	5.00	58
Gonial	15	117.39	5.58	+112
Mental	15	68.65	5.90	63

TABLE 5.—FACE POSITIONS

Position	No.	Average	S. D.	Class 3 99/8307
Auriculonasion	21	88.55	5.35	−83
Auriculoprosthion, superior	16	95.57	4.35	97
Auriculoprosthion, inferior	13	100.85	4.50	+108
Auriculomenton	13	113.85	7.40	+124

A diagram is often of great help in an endeavor to convey the meaning of numbers. Such a diagram can be constructed from combinations of different measurements. Thus, by combining the measurements in height of the face mask with certain measurements in depth (anteroposterior), a geometric figure can be obtained which will express in a concrete way what the numbers in the tables mean. The vertical dimensions of face mask and of ascending ramus were thus

plotted against the dimension from the earhole to the same points and against the anteroposterior dimension of the body of the mandible, all being projected in the sagittal plane. By this sort of treatment, the diagram shown by the dotted lines in Figure 5 is obtained. This diagram, although made up of a few measurements, satisfies all orthodontic purposes, because it presents the profile of the face. Moreover, since malocclusal conditions are classified on the basis of anteroposterior relationship of the teeth and jaws, the diagram adequately illustrates the points of greatest importance.

TABLE 6.—EUROPEAN WHITE ADULT MALES (W. R. U.)
Face Heights

Height	No.	Average	S.D.	Class 3		
				654	1043	337
Total face	42	120.43	7.02	123	118	−105
Upper face	42	71.93	4.29	75	67	−57
Lower face	42	33.26	3.66	37	32	31
Dental	42	15.55	2.60	−12	+19	+23
Nasal	42	51.50	3.60	54	50	−47
Subnasal	42	20.43	2.89	21	−17	−10
Palate	40	14.43	1.96	15	14	+19
Post. nares	42	29.36	2.32	−23	−27	−25
Molar region	42	28.50	3.00	27	30	−21
Condylar	42	64.79	4.11	+70	−55	−56
Coronoid	41	65.76	4.64	70	−56	−54
Sigmoid notch	42	13.86	1.93	14	− 9	−11

TABLE 7.—EUROPEAN WHITE ADULT MALES (W. R. U.)
Face Widths

Width	No.	Average	S. D.	Class 3		
				654	1043	337
Bizygomatic	42	132.74	4.79	−126	−123	−125
Bimalar	42	92.64	4.16	−87	−88	−86
Between upper cuspids lower	42	38.19	2.39	−32	37	−30
	42	33.69	1.90	+36	+36	+40
Max. alveolar arch, upper	40	62.40	3.14	61	60	−59
Max. alveolar arch, lower	38	68.05	2.92	66	+73	+72
Nasal	42	24.10	1.65	24	24	23
Post. nares	42	31.02	2.37	−28	30	30
Interorbital	42	23.72	2.36	22	25	−21
Palate (max.)	42	40.36	2.97	−34	39	−34
Palate (min.)	42	24.17	1.80	−19	25	−20
Bicondylar	42	118.71	6.51	−110	−109	−100
Bigonial	42	102.50	6.99	−92	102	96

The fact should not be overlooked that we are dealing also with the differences among individuals; and therefore variability, too, has to be accounted for. This has been done by adding to the outline in-

dicating the average two more outlines to indicate the variability of the individuals as it is expressed by the standard deviation. The outlines for the range of variability were obtained in the same way as those for the average, but the standard deviation was then added for the plus side and subtracted for the minus side of the average. The shaded figure presented in Figure 6 thus shows the limits within which the dimensions of the normal faces of the series are confined, the middle line representing the average of that group and the end lines the normal range of their variability. If we now wish to find out how any one skull would compare with the group, a like diagram should be constructed from its measurements and superposed on the standard. Thus, in Figure 7, is

TABLE 8.—EUROPEAN WHITE ADULT MALES (W. R. U.)
Face Depths

Depth	No.	Average	S. D.	Class 3		
				654	1043	337
Total palate	42	47.12	3.42	44	44	−40
Anterior palate	42	35.81	3.25	35	−31	−31
Posterior palate	42	11.31	2.77	9	13	9
Alveoloramus	42	80.90	4.08	77	83	78
Preramus	42	49.26	2.67	47	51	+53
Ramus	42	32.07	2.45	30	31	−26
Basal	42	77.21	4.77	77	80	+84
Alveolar arch, upper	41	48.39	3.48	46	46	−40
Alveolar arch, lower	40	48.65	3.05	46	51	49
Condylocoronoid distance	42	33.95	3.02	−24	−30	−26

TABLE 9.—EUROPEAN WHITE ADULT MALES (W. R. U.)
Face Angles

Angle	No.	Average	S. D.	Class 3		
				654	1043	337
Facial	42	85.12	4.09	+93	85	86
Alveolar, upper	42	69.21	6.66	+83	−58	69
Gonial	42	122.57	6.54	−115	127	123
Mental	41	57.97	7.20	54	−48	−34
Cuspid, upper	42	75.83	4.01	79	+82	−63

TABLE 10.—FACE POSITIONS

Position	No.	Average	S. D.	Class 3		
				654	1043	337
Auriculonasion	42	90.57	3.71	−86	87	−84
Auriculoprosthion, superior	42	97.15	4.26	−85	−90	−84
Auriculoprosthion, inferior	42	103.22	4.53	−95	103	107
Auriculomenton	42	118.93	4.83	−114	120	+125

shown a skull with the dentition in Class III malocclusion (heavy solid line) superposed on the standard of that group (shaded area). It shows quite clearly how the malocclusal face differs from the normal standard. This figure was obtained from some of the measurements in Tables 1-4. It shows that the upper face of the Class III skull is within the normal range of variability, while the mandible is not only anterior to it, but also larger than that of the standard. In this instance, though the total face is greater in height, the mandible is normal both in size and in position, but the upper face in the region of the dental and alveolar arches is really behind the standard for the normal. Judging from the evidence of this and several other cases of the same kind, it may be seen that the deviation is just reversed. Instead of the lower teeth being found mesially to the upper and the mandible being too far forward from the maxilla, the reverse is true.

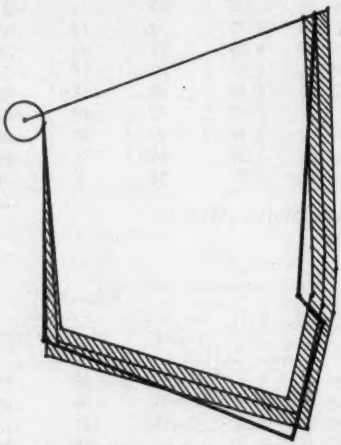


Fig. 8.—Diagram of facial profile, showing comparison between the average with its standard deviation (shaded area) of facial dimensions of twenty-five European white males *(AMNH)* with normal occlusion and of skull No. 4360 *(v.L.)* with Class III malocclusion (solid heavy line).

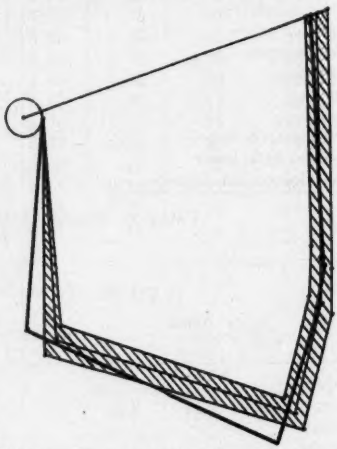


Fig. 9.—Diagram of facial profile, showing comparison between the average with its standard deviation (shaded area) of facial dimensions of twenty-five European white males *(AMNH)* with normal occlusion and of skull No. 4881 *(v.L.)* with Class III malocclusion (solid heavy line).

The matter does not end here, as there are other varieties of Class III. Figure 9 illustrates a condition which differs from the other two. In this instance, the teeth in the skull show the characteristic Class III malocclusion, but in position the jaws are in normal relationship to each other and to the group

as a whole. As is indicated by the heavy solid line, the outline of the face mask falls within the range of normal variation. The face is higher, the body of the mandible deeper, but instead of projecting forward, the mandible extends farther back than in the standard.

Another form of Class III malocclusion is seen in Figure 10, obtained from the measurements of Tables 5-8, superposed upon which is the skull No. 1043 (Western Reserve University). In this instance, the upper face is posterior from the standard, while the mandible in the chin region projects slightly anteriorly from it. From the same group of skulls, an extreme of this condition is illustrated in Figure 11, obtained similarly from Tables 5-8, but superposed upon the standard for the normal is the profile of another specimen (No. 105). In this instance, it is very clear that the entire face of the skull with the Class III dentition is shorter, the upper part of the face is subnormal in size and posterior in position, while the mandible is supernormal in size and anterior in position.

There are still other forms. Thus, Figure 12, obtained from the measurements of the same tables as the previous two but superposing the face of another skull from the same group (No. 654), illustrates an entirely different form of face with Class III malocclusion. In this instance, the particular features measured do not differ from the normal in dimension at all. But the position of the entire face is different, being completely posterior from the standard. The dental arches are in the same relationship to each other; namely, in Class III malocclusion. And, finally, there is one more form of face which differs from all the rest. As illustrated in Figure 13, obtained

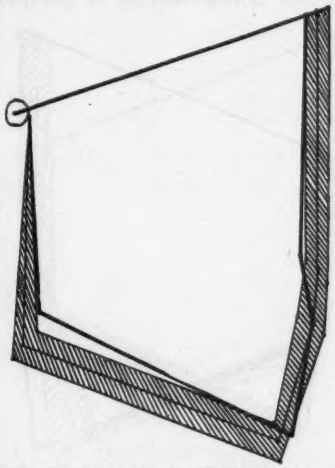


Fig. 10.—Diagram of facial profile, showing comparison between the average with its standard deviation (shaded area) of facial dimensions of forty-two European white males *(WRU)* with normal occlusion and of skull No. 1043 (solid heavy line) with Class III malocclusion.

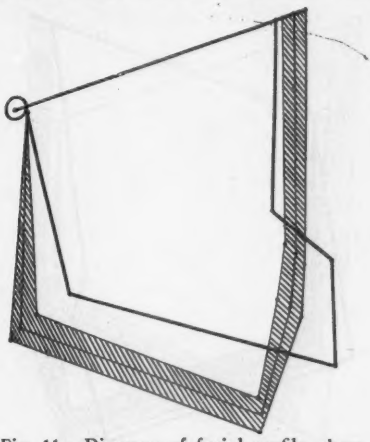


Fig. 11.—Diagram of facial profile, showing comparison between average with its standard deviation (shaded area) of facial dimensions of forty-two European white males *(WRU)* with normal occlusion and of skull No. 105 (solid heavy line) with Class III malocclusion.

from ten series of facial measurements of boys at the average age of 18.20 ± 1.78 (shaded area), and compared with it is the face of a boy (solid heavy line), aged 16½ years. In this illustration, it will be seen that the anteroposterior dimensions of the features concerned, with the exception of the ascending ramus, are not only larger, but also much farther forward than in the group. Of course, I am quite well aware of the fact that the number in this series of facial measurements is far too small for a satisfactory statistical analysis. It nevertheless is of interest even in this crude state.

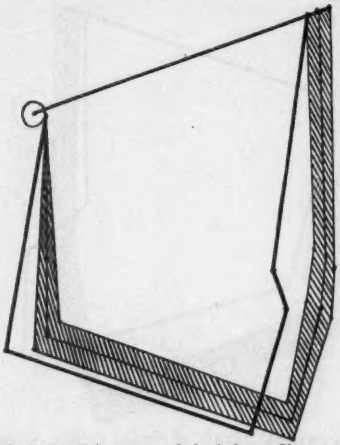


Fig. 12.—Diagram of facial profile, showing comparison between average with its standard deviation (shaded area) of facial dimensions of forty-two European white males *(WRU)* with normal occlusion and of skull No. 654 (solid heavy line) with Class III malocclusion.

The two illustrations following are repetitions of the varieties already shown, but because they appear in the living and because they show that similar comparisons can be made of the cases coming to the orthodontist for treatment, they are worth recording. Thus, the group standard shown in Figure 14 was obtained from 252 series of facial measurements of girls. With it is compared the face (heavy solid line) of a girl, age 15 years and 10 months, with Class III malocclusion. In this case, it is shown that the upper face is behind the range of variability of the group, while the lower is in front of it. In Figure 15, the standard was obtained from the same group, but superposed upon it is the face of another girl with Class III malocclusion. It shows a similar condition, but much more exaggerated. The dimensions of the upper face again are less than the group anteroposteriorly, but considerably more vertically, while the lower face is beyond the group in size and position.

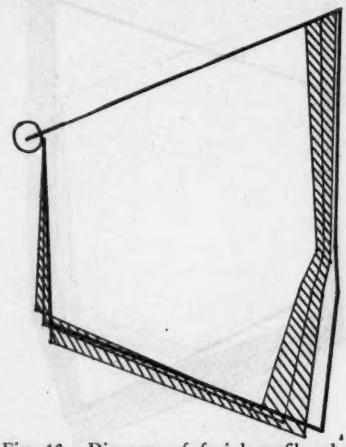


Fig. 13.—Diagram of facial profile, showing comparison between average with its standard deviation (shaded area) of ten series of facial dimensions of boys with all kinds of occlusion and of a 16½-year-old boy with Class III malocclusion (solid heavy line). (Age of group, 18.20±1.78.)

What of the form of face in Class III malocclusion of the teeth? If we grant that there is a large variety of forms, what bearing has this fact on the practical aspect of orthodontia? The answer is not difficult. In the treatment of Class

III malocclusion of the teeth, it is the general consensus of opinion that the lower teeth should be moved distally in order to establish normal occlusion. Of course, this is quite natural, since the lower teeth are supposed to be mesially from the normal. Some orthodontists even lay claim to the fact that they actually do move the teeth distally. The proof that this has been accomplished is lacking. The fact entirely lost sight of when such claims are made is that the patients under the care of the orthodontist are still in the developmental period of life. Their faces have as yet not reached the adult state and are still undergoing active growth. Of course, there is nothing new in this. John Hunter[4] spoke of jaw growth almost 200 years ago. Dr. Noyes,[5] in 1908, was the first to call attention to this fact in connection with orthodontia. He used to make a special feature of it in his course of lectures at the Angle School, where I received my first inspiration. Original observation, intensive study, the accumulation of more evidence, the adoption of scientific methods of investigation and contact with W. K. Gregory and T. W. Todd,[6] have brought about many changes in my views, but the fundamental idea holds. A detailed account of this matter was given in 1927.

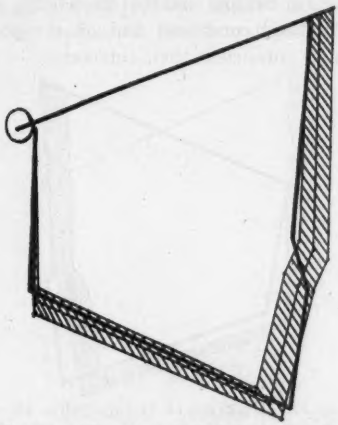


Fig. 14.—Diagram of facial profile, showing comparison between the average with its standard deviation (shaded area) of 252 series of facial dimensions of girls with all kinds of occlusion and of a 16-year-old girl with Class III malocclusion (solid heavy line). (Age of group, 14.89±2.16.)

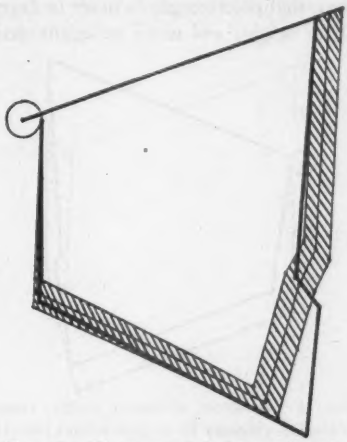


Fig. 15.—Diagram of facial profile, showing comparison between average with its standard deviation (shaded area) of 252 series of facial dimensions of girls with all types of occlusion and of a 13-year-old girl with Class III malocclusion (solid heavy line). (Age of group, 14.89±2.16.)

Since then, additional evidence has been gathered which supports the general facts revealed. It is now known that, during the course of development, the child's face keeps on increasing in size.

4. Hunter, John: The Natural History of Human Teeth, 1771.

5. Noyes, F. B.: Alveolar Process, Am. Orthodontist, 1 (May) 1908.

6. Todd, T. W.: Skeletal Adjustment in Jaw Growth, Dent. Cosmos, 68:1168 (Dec.) 1926. Gregory, W. K.: Our Face from Fish to Man, New York: G. P. Putnam's Sons, 1930.

This increase in size is due to growth. But growth of the face does not take place in one direction only. The face actually grows in three directions. It grows up and down; it grows from side to side; and it grows from front to back. In other words, it grows in height, in width and in depth. It is now also known that when the face grows much in one direction, it grows less in the other two directions; that is, growth is not continuous in one part or in one region; it alternates. Moreover, it is now also known that the face grows more in depth than in height, and more in height than in width. It is also known that growth in depth occurs earlier than that in height and that growth in width is associated with both growth in height and growth in depth, but proceeds at a slower pace. Therefore, the proportions of the face undergo considerable change in the course of development. But what is of particular significance is the recognition of the fact that growth is not uniform. Sometimes, the same part grows faster, sometimes slower; i. e., growth occurs in spurts.

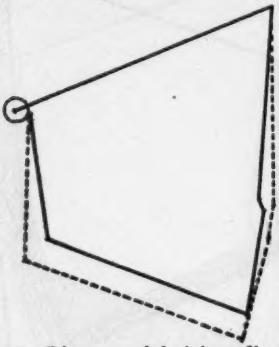


Fig. 16.—Diagram of facial profile, showing growth changes in a girl with Class III malocclusion, at 6 and 7½ years of age.

Of equal importance to the orthodontist is the recognition of the fact that, in the development of the face, as it is expressed by increase in size and change in proportion, there is also a change which affects its position; that is, the face adjusts itself to the increments of growth. For example, when the face increases its size in depth—anteroposteriorly—actual growth takes place behind, but as this is occurring, the entire facial mask migrates forward. This migration is greater in the chin region than it is in the frontonasal region. It appears now that the recognition of these facts does have a practical bearing on the knowledge of malocclusal conditions and on the procedures entailed in their correction.

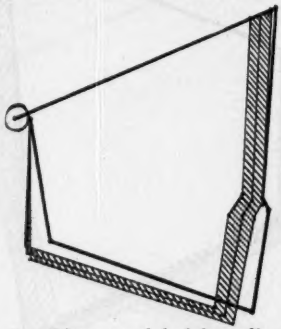


Fig. 17.—Diagram of facial profile, showing comparison between average with its standard deviation of fourteen series of facial dimensions (shaded area) of girls with all types of occlusion at stage 3C and of one girl with Class III malocclusion (solid heavy line). (Age of group, 6.50±0.62.)

If an interpretation is now made of the meaning of the different forms of faces with Class III malocclusion, why they are so varied will be more understandable. Thus, some forms may be due to disturbances in growth, some to disturbances in proportions and some to disturbances in adjustment. An example from actual experience will illustrate this. Figure 16 shows two diagrams of the facial profile of a girl with Class III

malocclusion. One (solid line) represents the face at 6 years of age, the other (broken line), one and a half years later. When the child was first examined, the deciduous dentition was still intact, in addition to which the lower right permanent first molar was fully erupted, while the left had just pierced the gum. The upper permanent first molars were still absent. In the illustration, it is quite clear that, at this time (solid line), the maxilla is farther back than the mandible. A year and a half later (broken line), the entire face had increased in height and depth very considerably. But

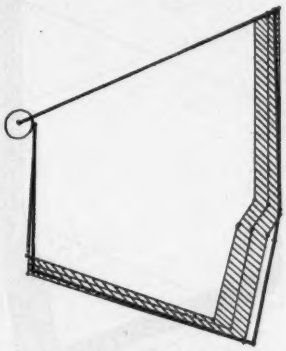


Fig. 18.—Diagram of facial profile, showing comparison between the average with its standard deviation (shaded area) of 107 series of facial dimensions of girls with all types of occlusion and of a 7½-year-old girl with Class III malocclusion (solid heavy line). (Age of group, 8.40±1.14.)

it should be noticed that the maxilla has migrated forward more than the mandible. This was, no doubt, due to an increase in growth behind the upper deciduous dentition, because, coincidently with this growth, the upper permanent first molars erupted. Thus, both growth and adjustment brought about the changes shown in the illustration. But the interesting feature about it is that there was an improvement also in the relationship of the teeth. Whereas, the Class III manifestation was very marked at the beginning, the lower deciduous incisors and cuspids projecting considerably beyond the upper, it was improved later to the extent that only one of the two permanent upper central incisors which had erupted was situated lingually from the lower, the other being in normal occlusion. The change in the form of the profile was also marked. If a comparison of these diagrams is made with the standards for the respective age groups, these changes become more understandable. Thus, in Figure 17, it is

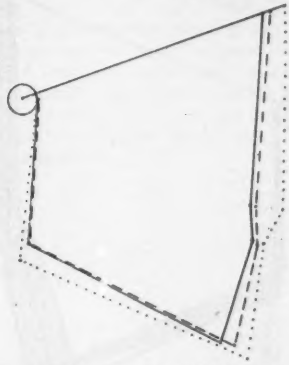


Fig. 19.—Diagram of facial profile, showing growth changes in a boy with Class III malocclusion at 10 years (solid heavy line), 11½ years (broken line) and 12 years and 4 months (dotted line).

quite evident that the differences were due both to disturbances in growth and to failure of adjustment. Figure 18, on the other hand, shows that the subsequent favorable growth and adjustment brought the face of this girl closer to the standard for the group. The upper face is now within the range of variability of the group and the mandible is considerably closer to it than it was before. It should be emphasized that this case was not treated. It is still under observation.

Growth is not always favorable. In Figure 19 are shown three diagrams of the facial profile of a boy at 10, 11½ and 12½ years of age with Class III malocclusion. In this instance, growth during the first year and a half (solid and broken lines) was not so great as in the previous case. The boy was older. Growth at this period is not so marked. Whatever growth took place there was none at all in height and little anteroposteriorly. But growth in the mandibular region was greater than that in the maxillary region (broken lines). Orthodontic treatment was then started, and in less than one year, the mesiodistal relationship of the teeth was established. The subsequent change in the profile is seen by the dotted line. But of particular interest in this case is the remarkable growth at this time in the entire face and the reverse change in the relative position of the maxilla and the mandible. Particular notice should be taken of the extent of forward migration of the upper and lower alveolar arches.

A comparison of the facial diagrams of this boy at the different stages with the standards for the respective age groups will show the nature of these changes. Thus, Figure 20 shows that, in the beginning, this boy's face (solid line) was higher than the group, but the anteroposterior dimensions did not exceed the range of variability, although he had Class III malocclusion. The upper face was well within the range of variability, while the mandible was on the maximal border line. The comparative diagram one and a half years later (Fig. 21, solid line) shows that the mandible has increased in size and changed in position beyond the variability of the group. After the correction of the occlusal disturbance,

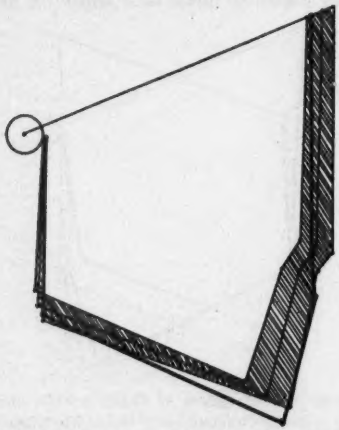


Fig. 20.—Diagram of facial profile, showing comparison of average with its standard deviation (shaded area) of 121 series of facial dimensions of boys with all types of occlusion and a 10-year-old boy with Class III malocclusion (solid heavy line). Age of group, 10.91±1.35.)

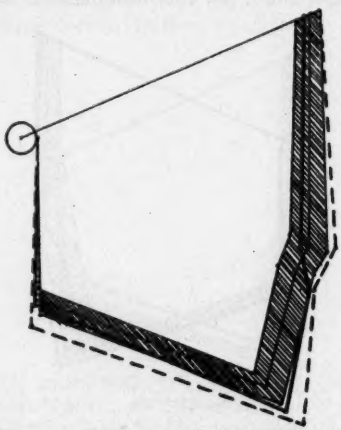


Fig. 21.—Diagram of facial profile, showing comparison between the average with its standard deviation (shaded area) of fifty-seven series of facial dimensions of boys with all types of occlusion and one boy at 11½ years with Class III malocclusion (solid heavy line) and the same boy a year later with normal occlusion (broken line). (Age of group, 12.70±1.25.)

a year later (Fig. 21, broken line), the entire face has grown in excess of the group, but the mandible is still projecting farther forward than the maxilla, despite the fact that normal occlusion was established. (The position of the facial profile indicated by the broken line in relation to the group is the same as that shown in Figure 13. This confirms the probability of such form, because it is worked out from fifty-seven series of facial measurements.) In this case, the effect of orthodontic treatment is shown not in the increments of growth, but rather in the change of the relative position between the upper and lower jaws. The upper jaw seems to be considerably more affected in its anterior migration than the lower, although both have drifted forward.

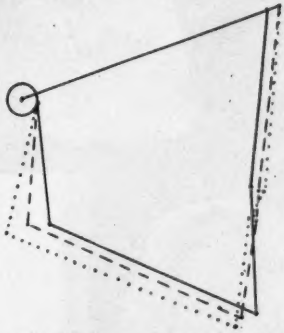


Fig. 22.—Diagram of facial profile, showing growth changes in girl with Class III malocclusion at 8 years, before treatment (solid heavy line), at 9 years, during course of treatment (broken line), and at 10 years, after completion of treatment (dotted line).

The effects of orthodontic procedure are not always the same. In the following case, an entirely different picture is presented by the result obtained from orthodontic treatment. Figure 22 shows the facial diagrams of the profile of a girl at 8, 9 and 10 years of age. The solid lines represent the face in Class III malocclusion; the broken lines, one year after treatment has been begun, and the dotted lines, when the normal mesiodistal relation was established. The change in the face of this girl is in position, adjust-

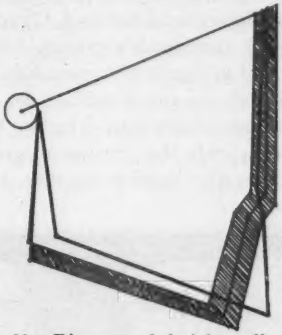


Fig. 23.—Diagram of facial profile, showing comparison between average with its standard deviation (shaded area) of 107 series of facial dimensions of girls with all types of occlusion and an 8-year-old girl with Class III malocclusion (solid heavy line). (Age of group, 8.40±1.14.)

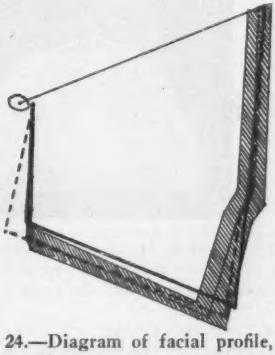


Fig. 24.—Diagram of facial profile, showing comparison between average with its standard deviation (shaded area) of 159 series of facial dimensions of girls with all kinds of occlusion and 9-year-old girl during course of treatment of Class III malocclusion (solid heavy line) and the same girl 1 year later with normal occlusion (broken line). (Age of group, 10.52±1.37.)

ment and direction of growth. It should be observed that, because of the pull exerted by the intermaxillary muscles, the mandible readjusted itself backward and the maxilla migrated forward. Of course, there was considerable growth both in height and in depth, but coincident with this growth, the intermaxillary force appears to have exerted an influence to reverse completely the direction of growth, as well as the relative position of the mandible, but also its forward position. Figure 24, one year later (solid line), shows that the increase in growth was not nearly so great as the change in position. In this instance, the superimposed diagram of the girl's face falls very close to the group. But the greater change occurred one year later (broken line). At this time, the anterior aspect of the facial diagram falls completely within the variability of the group. But, because of the

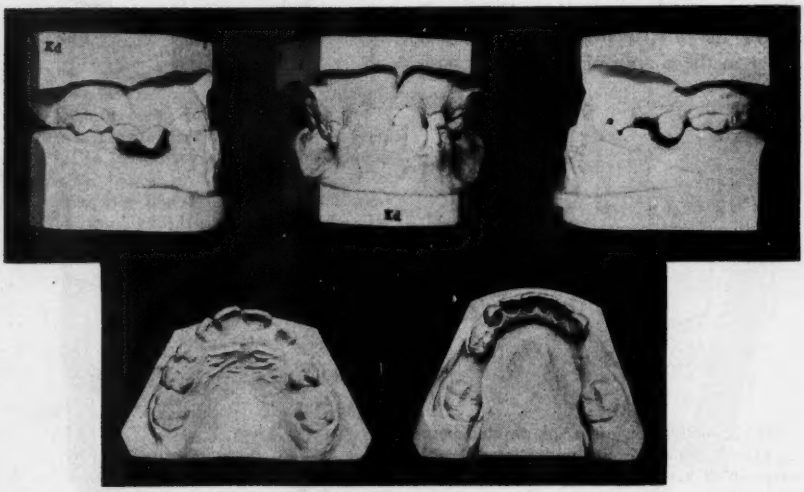


Fig. 25.—Casts of dentition with Class III malocclusion, showing diminution of upper dental arch to extent of obliterating spaces for upper second bicuspids. The upper permanent first molars moved forward and the teeth in front of the molars failed to do so.

maxilla to that of the mandible. As seen in the illustration, the mandible has grown, but it extends farther back.

Did this change establish the normal? Comparisons of these profiles with the standard for the respective age groups will furnish the answer. Figure 23 shows the superposition of the face with the Class III malocclusion upon the standard for the group. The difference shown is in not only the excessively deep man- excessive increase in the size of the body of the mandible, the posterior end projects backward beyond that of the group. It is thus seen that orthodontic treatment had little effect on growth; i. e., it did not stop the growth of the mandible. But it did have a marked influence on the direction of growth and on the adjustment of the face mask.

Now, what is the effect on the face years after orthodontic treatment has

been successfully completed? It is generally assumed that, after the dentition of a case of malocclusion has been restored to normal occlusion, Nature will take care of it thereafter. I know of no evidence that this is a fact. The matter seems to be taken for granted. I was curious enough to follow up quite a number of my treated cases, in order to learn how Nature acts in these cases. To this end, an attempt was made to get in touch again with patients several years after they were dismissed, to ascertain what actually happened. Six patients who originally had Class III malocclusion returned. In four of them, the occlusion was fine. In two, there was trouble. The story of one of them, being more nearly complete, will be related. A boy, aged 8 years (Fig. 25), came under my care in 1921. At that time, I had not as yet adopted the method of appraising cases of malocclusion by means of facial measurements. Of course, from the appearance of the molar occlusion in the casts some may contend that this case belongs to Class I. But it is really in Class III, because the upper molars had moved forward considerably because of the loss of the upper deciduous second molars. The occlusal view of the upper dental arch (Fig. 25) shows this very plainly. Treatment was begun. Intermaxillary force as used in Class III was applied at once.

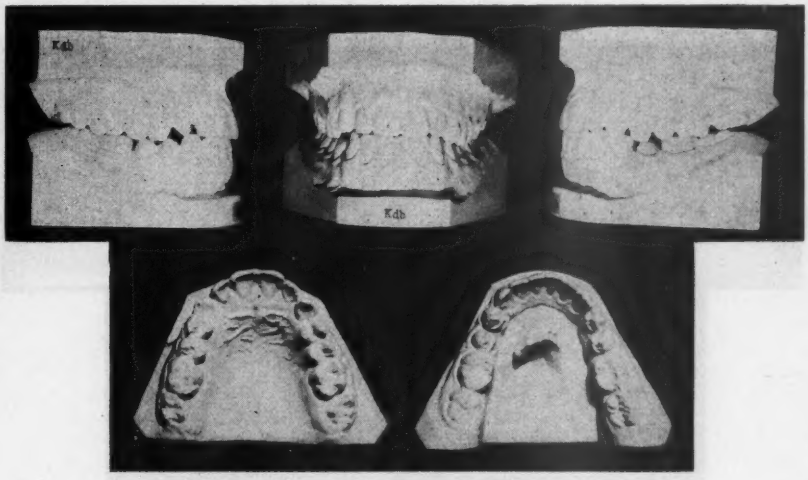


Fig. 26.—Casts of dentition in Figure 25 after completion of orthodontic treatment, showing increase in size of upper dental arch with establishment of normal relationship between dental arches and teeth.

Although the upper molars were not distally to the lower, or vice versa, the intermaxillary pull prevented them from distal movement, while the teeth in front of the molars were being moved anteriorly, to reestablish the spaces for the upper second bicuspids. In 1925, the treatment was completed, as is shown by the casts in Figure 26. The dentition being then in normal occlusion, the retaining appliances, which had been worn for about a year, were discarded. The upper

right cuspid was still in the course of eruption. The patient was then 13 years and 5 months old. One year and seven months later, or when the patient was 15 years old, the dentition looked as is shown by the casts in Figure 27. It would seem that the result was a success. The patient was dismissed. Last December, while I was preparing this paper, I got in touch with this boy in order to again check up. It occurred to me that although occlusion was normal when the patient was last seen, the boy was still growing. I was now interested to see what growth changes had taken place during the three years since the last visit.

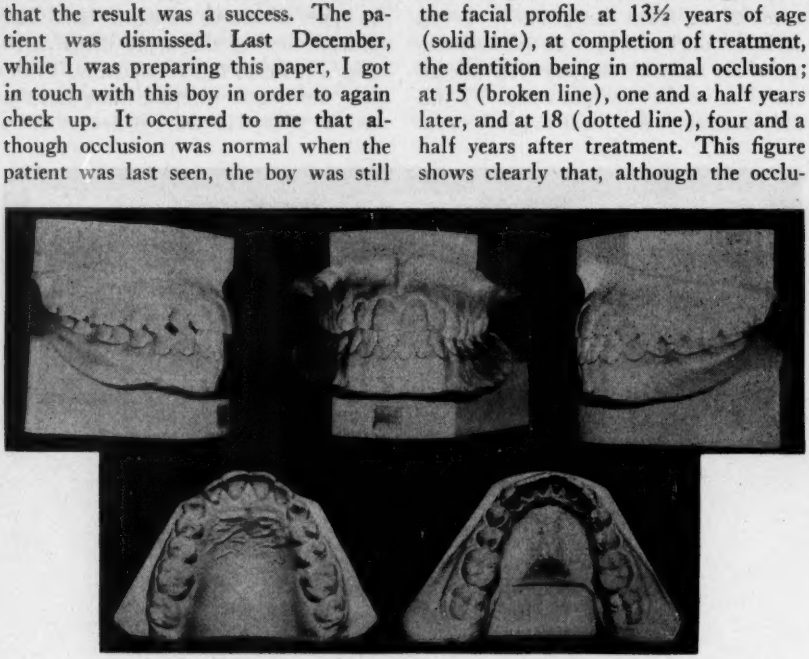


Fig. 27.—Casts of dentition in Figure 25, one and a half years after treatment, showing successful result maintained.

Figure 28 shows the casts of the dentition three years after I had become satisfied that the result was successful and four and a half years after completion of treatment. It is quite noticeable that the left side has drifted into Class III again. What happened? Referring to the measurements for an explanation, I found that there had been two series taken; one when the treatment was completed, the other, a year and a half later. I took a third set now, and a comparison of the three series revealed some interesting facts. Figure 29 shows the diagrams of the facial profile at 13½ years of age (solid line), at completion of treatment, the dentition being in normal occlusion; at 15 (broken line), one and a half years later, and at 18 (dotted line), four and a half years after treatment. This figure shows clearly that, although the occlusion of the teeth was restored to normal, the growth of the face continued. But the tendency of growth of the mandible was not so desirable for the preservation of the normal relationship of the teeth. As seen in this figure (broken line), the anteroposterior growth was considerable, but the face appears to have adjusted itself satisfactorily. The teeth retained their normal occlusion, because there also was considerable forward migration of the entire face mask. In the subsequent

three years (dotted line), there was again a spurt of growth of the entire face, but the mandible seems to have grown at this time much more than the maxilla. The mandible adjusted itself quite satisfactorily, extending backward much more than before; but this was not enough to preserve the orthodontic results. The tendency of the mandible to project beyond the maxilla in front still persisted. If comparisons are now made between this face and the standard for the faces of the respective age groups, the more in the mandible, projecting it into the area of the group anteriorly and beyond that of the group posteriorly. The upper face is left behind. In the following three years (broken line), more growth brought the entire face within the group area in front, beyond it vertically and behind it horizontally. The mandible extends forward relatively more than the rest of the face. It is obvious that growth and adjustment were out of balance. What is the trouble? The treatment of this, as well as of the

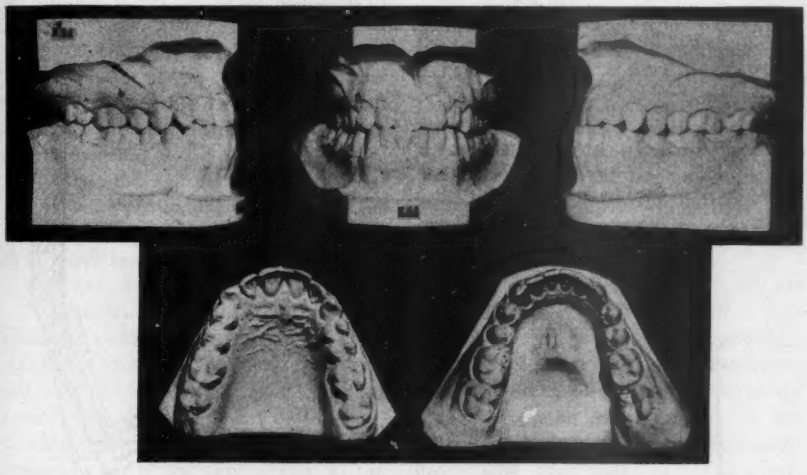


Fig. 28.—Casts of dentition in Figure 25, four and one-half years after treatment, showing recurrent disturbance on left side due to excessive growth of mandible.

reason that the malocclusion reappeared is shown rather well. Thus, in Figure 30, the face with the dentition in normal occlusion at the completion of treatment is shown to be close to the group standard. In fact, the mandible appears somewhat shorter anteroposteriorly than that of the group. But in Figure 31 (solid line), there is quite a change. There has been an increase in the vertical and anteroposterior dimensions throughout. But the anteroposterior dimension increased other case with the same story, was completed at 15 years of age. In four other cases, the treatment was completed at 18. It is known that between the ages of 15 and 18, there is an acceleration of growth, particularly in boys. The face is evidently not exempt from it. Does it not seem that this fact has been entirely overlooked? The reason for this fact, it seems, is the lack of that knowledge which is needed for a complete appraisal of the entire problem entailed in Class

III malocclusion, as it presents itself to the orthodontist.

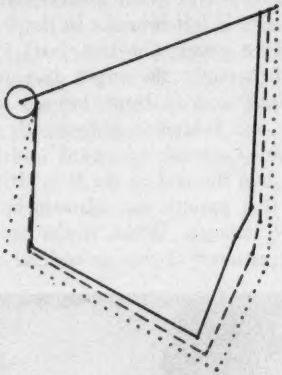


Fig. 29.—Diagram of facial profile, showing growth changes in boy with normal occlusion, after treatment of Class III malocclusion, at 13½ years (solid heavy line), 15 years (broken line), and 18 years (dotted line).

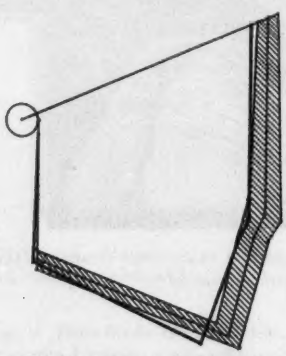


Fig. 30.—Diagram of facial profile, showing comparison between average with its standard deviation (shaded area) of fifty-seven series of facial dimensions of boys with all types of occlusion and one boy at 13½ years with normal occlusion after treatment of Class III malocclusion (solid heavy line). (Age of group, 12.70±1.25.)

The chief reason for bringing this topic to the attention of the orthodontist is obvious. What I have endeavored to point out particularly may be summed up as follows:

SUMMARY

1. Simplification in classifying anything, especially malocclusion of the teeth, may be carried to extremes.

2. The manifestation known as Class III malocclusion of the teeth is not so simple a phenomenon as it is assumed to be.

3. While the occlusion in Class III is such as to show a mesiodistal disturbance in the relationship between the upper and lower teeth, there is as little certainty that the lower teeth are situated mesially to the upper as there is that the upper are situated distally to the lower.

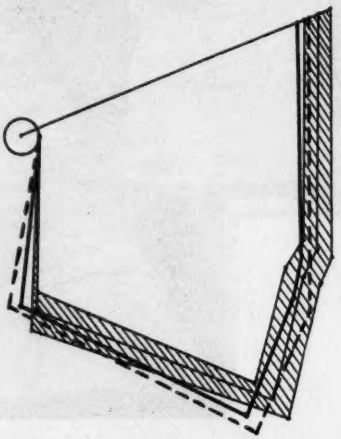


Fig. 31.—Diagram of facial profile, showing comparison between average with its standard deviation (shaded area) of 154 series of facial dimensions of boys with all types of occlusion and 15-year-old boy with normal occlusion, after treatment of Class III malocclusion (solid heavy line), and same boy three years later (broken line). (Age of group, 14.78±2.07.)

4. The results obtained from dependable anthropometric procedures support

the view that, in Class III malocclusion: (*a*) the entire face may be equal to normal, in position but not in dimension; (*b*) only a part of it may be equal to normal in size and position and the rest of it deviate; (*c*) the entire face may be either infranormal in position or supranormal in dimension and position, and (*d*) only a part of the face may be infranormal and the other supranormal, either in size or in position, or both in size and in position.

5. The effect of Class III malocclusion on the face is not due to the occlusion of the teeth; but, rather, the occlusion of the teeth, and the size of the jaw bones, as well as that of the entire face, are determined by certain disturbances which interfere with balance and harmony in development.

6. Repeated and careful observations on the same individual demonstrate the fact that growth changes are as liable to improve in the course of development as they are to become worse.

7. Rational orthodontic treatment of Class III cases of malocclusion produces influences which do not affect growth itself, but which do affect the direction of growth and the adjustment of the face, provided they are carried out at proper periods of life in the development of the individual.

8. The tendency toward inharmonious growth in Class III cases may persist even after orthodontic treatment has been successfully consummated.

CONCLUSIONS

It may therefore be concluded that

1. The occlusal relationship of the teeth in Class III malocclusion is only a relative one; i. e., while the lower teeth are anterior to the upper, it is not certain which of the two dental arches is in its normal anteroposterior position.

2. The position of the teeth can be determined only by a scientific appraisal of the size and position of the jaws and face, using such methods as were demonstrated or any other method which may prove satisfactory for the purpose.

3. The distal movement of the lower teeth in the treatment of Class III cases, as is claimed by orthodontists, may prove to be totally wrong, if the position of the face does not warrant it.

It would seem, then, that, after all, the theoretical aspect of malocclusion does have a practical value. By the introduction of a scientific method for appraising malocclusion, a means is also furnished for an adequate understanding of the changes brought about by the mechanical procedures employed in orthodontic treatment.

THE RELATION OF GROWTH VELOCITY TO THE QUALITY OF THE ENAMEL*

By JOHN H. SWANSON, M.S., Cleveland, Ohio

THE purpose of this paper is to show that, in man, a correlation exists between the quality of a given portion of enamel and the rate at which the individual was growing when that portion was laid down.

HISTORICAL REVIEW

Dentists have vaguely associated poor quality of enamel with rapid rate of body growth since very early times. Belief in this relationship has been formally attested to by Hellman (1923).[1] Spier (1918)[2] believed in a relationship of rate of growth to dentition. Certain articles of recent appearance have tended to discredit this hypothesis. Thus, it may be concluded from Robertson's (1915 and 1923)[3] accounts that growth is more rapid one and a half months after parturition than at any other period in ontogeny; but the early months of the lactation period (hence 1½ months of age) were cited by Mellanby (1927)[4] as favorable to enamelization. On the other hand, the period between 1 and 2 years of age was cited by Robertson[3] as one of slow body development; and enamel deposited at this time (in supposedly syphilitic, though probably normal, molar teeth) was referred to by Karnosh (1926)[5] as of poor quality. According to McCollum and Simmonds (1929),[6] rapid rate of growth has no adverse influence on the process of dentition in either domestic or laboratory animals.

It is well known that graphs representing mass increase in man take the general plan of a sigmoid curve. This curve, according to Brody (1927),[7] may be divided into two major segments, each of which is divisible in turn into definite subsegments. Robertson[3] and Brody[7] have reported on the contour of some of

*Contribution from the Laboratory of Histology and Embryology of Western Reserve University and from the Laboratory of Biology in Missouri Valley College.

1. Hellman, Milo: Nutrition, Growth and Dentition, Dent. Cosmos, 65:34-49 (Jan.) 1923.

2. Spier, Leslie: Physiological Age: Relation of Dentition to Body Growth, Dent. Cosmos, 60:899-905 (Oct.) 1918.

3. Robertson, T. B.: Studies on Growth of Man. 1. Prenatal and Postnatal Growth of Infants, Am. J. Physiol., 37:1-42 (Jan.) 1915; Chemical Basis of Growth and Senescence, Philadelphia: J. B. Lippincott Co., 1923.

4. Mellanby, May: Structure of Human Teeth, Brit. Dent. J., 48:737-751 (July 1) 1927.

5. Karnosh, L. J.: Histopathology of Syphilitic Hypoplasia of Teeth, Arch. Derm. & Syph., 13:25-42 (Jan.) 1926.

6. McCollum, E. V., and Simmonds, Nina: Newer Knowledge of Nutrition, Ed. 4, New York: The Macmillan Company, 1929.

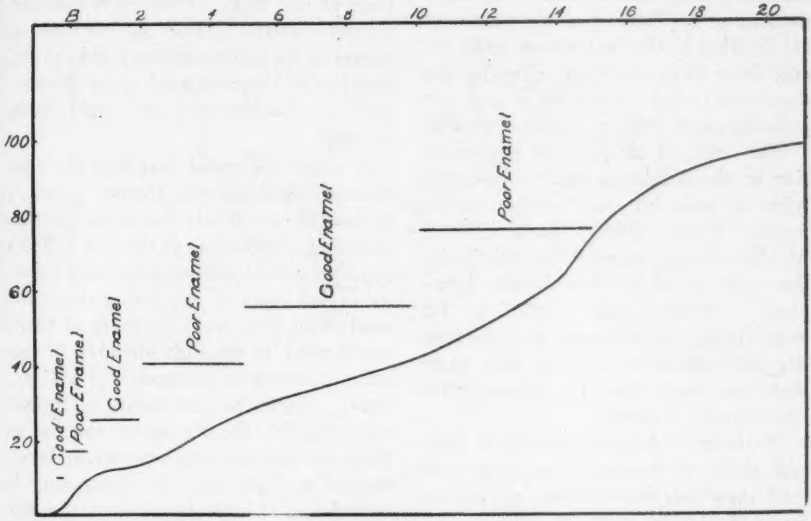
7. Brody, S.: Growth and Development with Special Reference to Domestic Animals. III. Growth Rates, Evaluation and Significance, University of Missouri Agricultural Experiment Station Research Bull. No. 97, 1927.

these subsegments. The following is an expression of the nature of mass increase according to the former writer (1923)[8]:

> . . . the rate of growth "in utero" during the first half of gestation is so slow that the weight of the human fetus is inappreciable in comparison with that of the mother during this period. This interval of slow growth is succeeded by the extraordinarily rapid accretion of tissue which characterizes development during the months immediately prior to and succeeding delivery.

In 1927, Mellanby reported a study of enamel hypoplasia in 1,036 deciduous and 266 permanent teeth. In the deciduous set, 14 per cent of the incisors, 54 per cent of the cuspids, 73 per cent of the first molars, and 92 per cent of the second molars were notably hypoplastic.

In a recent (1931)[9] paper in which incremental lines were interpreted, I reported that (1) enamel deposited in the permanent teeth during the months just



Curve of growth (after Robertson and Brody) and its relation to enamel quality. The curve represents age plotted against percentage of mature weight.

Towards the end of the first year of extrauterine life, however, there occurs a definite slackening of growth which is not an artefact, dependent upon weaning, since it occurs just as strikingly in artificially fed infants as in infants which are suckled. This resting period or "plateau" in the curve of growth is succeeded by the relatively rapid growth of the third, fourth, and fifth years of life. Another pause or slackening of growth succeeds this, to be followed by the energetic growth which accompanies adolescence.

8. Footnote 1, second reference.

prior to and succeeding birth is of poor quality; (2) the foregoing months are succeeded by a period which favors enamelization and which lasts until the child is about 2 years old; (3) the third, fourth and fifth years of life are inimical to calcification; (4) between the approximate ages of 5 and 10, conditions are

9. Swanson, J. H.: Age Incidence of Lines of Retzius in Enamel of Human Permanent Teeth, J. A. D. A., 18:819 (May) 1931.

favorable to enamelization, though not highly so, and (5) the years grouped around puberty are unfavorable to enamel deposition.

DISCUSSION OF EVIDENCE

Calcification of the first permanent molar begins while the crowns of the deciduous molars are forming; and it has been shown (Mellanby,[4] Swanson[9]) that enamel deposited at this time is usually of inferior quality. Since there is no other instance of overlapping of the process of calcification in the two sets of teeth, we may infer that conditions affecting the deposition of salts in one set of teeth are probably prone to affect the other set also.

The order of inception of enamelization in the deciduous teeth corresponds with the order of their position in the mouth (Pierce, 1884[10]; Black, 1914).[11] Mellanby's data indicate that this is also the order in which they develop hypoplasia. Hence, good conditions for enamelization must prevail in early fetal life, and calcification must take place under increased difficulty as intrauterine development proceeds.

Mellanby's[2] data on deciduous teeth and those of Swanson[7] on permanent teeth show that the following age periods favor the laying down of enamel: (1) from the inception of calcification to about the sixth month of fetal life; (2) from about the sixth month after birth until the child is approximately 2 years of age, and (3) from the end of the fifth year until about the age of 10. These age periods, as shown in the accompanying graph, correspond with the years referred to by Robertson[8] as characterized by slow growth.

The data of Mellanby[4] and Swanson[9] show that the following periods are inimical to calcification: (1) from the sixth fetal month to the sixth month after birth; (2) the third, fourth and fifth years of life, and (3) the years grouped around puberty. These age periods, as shown in the accompanying graph, correspond with those referred to by Robertson[8] as characterized by rapid body growth.

It should be stated here that the two accounts of Robertson are not in exact agreement as to where the second growth cycle falls. According to the first (1915) account, growth attains maximum velocity at 5.5 years of age, while the point marked by most rapid accretion of tissue comes prior to the fifth birthday in this cycle according to the second (1923) account. Since the statements of dental embryologists do not agree exactly in their expressions concerning crown development at these ages, the discrepancy is regarded as of little significance from the standpoint of the problem at hand.

SUMMARY

A correlation exists between velocity of mass increase in man, as reported by Robertson, and the quality of the enamel that is laid down in the teeth. Age periods marked by rapid accretion of tissue are inimical to calcification, while periods of slow body growth favor the formation of the teeth.

10. Pierce, C. N.: Calcification and Decalcification of Teeth, Dental Cosmos, 26:449-455 (Aug.) 1884.

11. Black, G. V.: A Work on Operative Dentistry, Vol. 1: Pathology of Hard Tissues of Teeth, Ed. 2. Chicago: Medico-Dental Publishing Co., 1914.

TECHNIC FOR THE USE OF SLOTTED TRAY FOR SECTIONAL PLASTER IMPRESSIONS

By J. V. GENTILLY, D.D.S., Cleveland, Ohio

THE technic here described applies a principle of vertical and horizontal slots of varying lengths and widths for the determination of grooves in a dental plaster impression, also for obtaining a more accurate plaster model and thereby preserving and duplicating the contour and continuity of the dental structures.

A mass plaster impression technic with simple equipment and means of predetermining the position for cleavage of the plaster so that the break is made with as few pieces resulting as possible is of more interest to the average dentist than the methods requiring skill, time and elaborate equipment.

Various types of special trays have been introduced for use in sectional impression making. Most of these trays, like the method, are sectional. They are made in two, three and four sections, assembled and held in place with clamps or screws while the impression is being taken. After the plaster has set, the operator begins to dissemble the parts, removing with them all pieces of plaster that are retained in the tray sections.

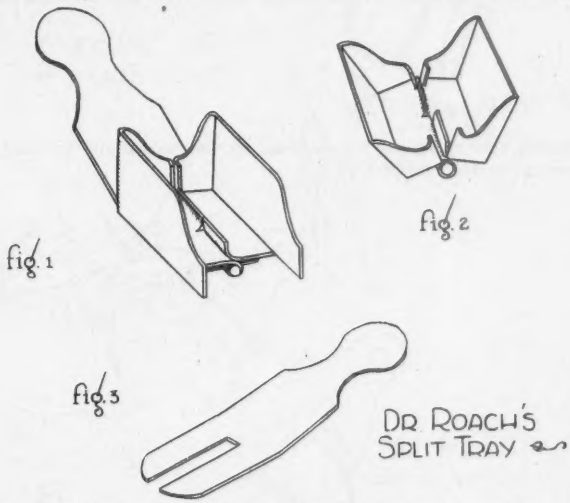


Fig. 1.—Roach hinged split tray, used mostly in taking impressions of individual teeth for clasp construction.

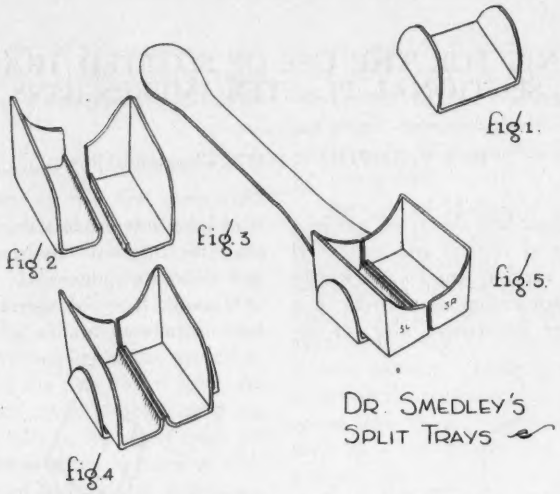


Fig. 2.—Smedley split tray, in which sections are unattached and are held together with clamp; an improvement on Roach tray.

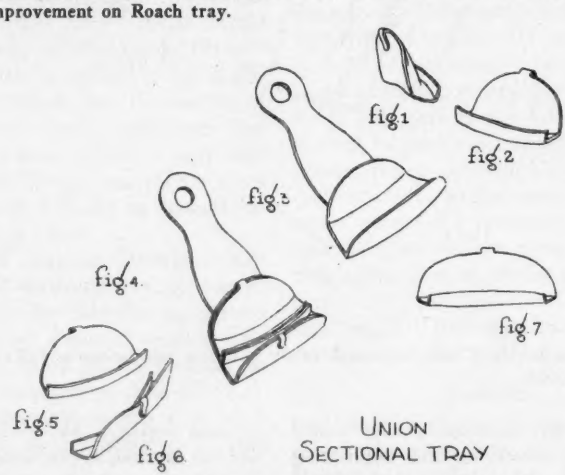


Fig. 3.—Union sectional tray, made by Union Broach Co., and consisting of removable sections made to fit on ordinary crown and bridge tray. This tray covers more area than either the Roach or Smedley trays and can be used for making sectional impressions for small bridges.

Plaster adhering to the teeth is then removed and fitted into place. Some of these sectional trays are necessary in impression work, while others are useless. Their object is primarily to produce cleavage of the plaster along the crest of the ridge and occlusal surfaces of the teeth, so that sections can be removed

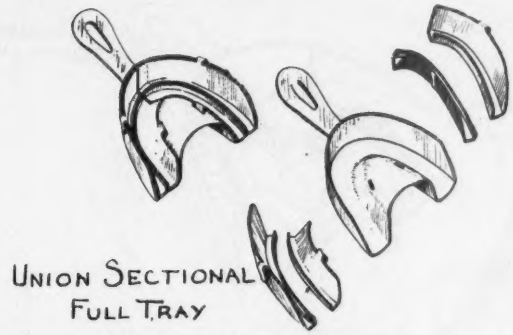


Fig. 4.—Union sectional full tray, which applies to full impression tray principle illustrated in Figure 3.

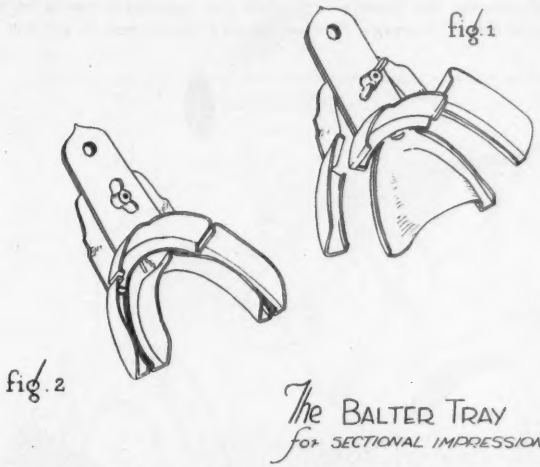


Fig. 5.—The Balter tray, first sectional tray constructed for full-mouth sectional impressions. Because of its cumbersome shape, it has not found favor with many dentists.

bucally, labially and lingually. This is accomplished by constructing the tray in two sections, one for the buccal and one for the lingual aspect. Cross-sectionally these sections represent the capital letter L facing itself, with the short upright arms in the middle. These trays must be purchased, as they are not easy to make.

Among the most important of these trays are:

1. The Roach hinged split tray, used mostly in taking impressions of individual teeth for clasp construction. (Fig. 1.)

2. The Smedley split tray, an improvement on this tray, in which the sections are unattached and are held together with a clamp. (Fig. 2.)

3. The Union sectional tray, made by the Union Broach Co., which consists of removable sections made to fit on an ordinary crown and bridge tray. This tray

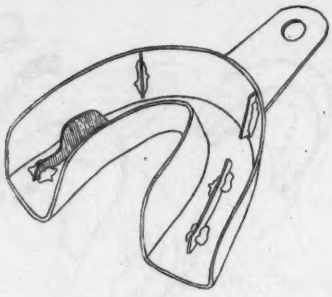


Fig. 6.—Tray illustrating Dr. Dowd's suggestion that pasteboard pieces be waxed to floor of tray to determine line of cleavage. The pasteboard pieces tend to get lost or shift from their attachment.

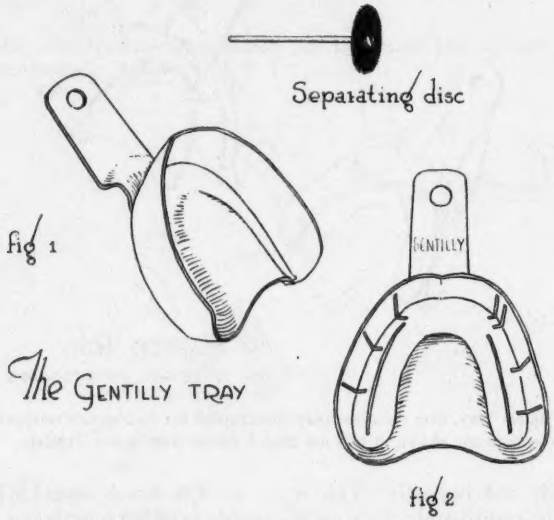


Fig. 7.—Ordinary impression tray before and after it has been prepared with slots.

covers more area than either the Roach or the Smedley tray and can be used for making sectional impressions for small bridges.

4. The Union sectional full tray, which applies the same principle to the full impression tray. (Fig. 4.)

5. The Balter tray, which was the first sectional tray constructed for full-mouth sectional impressions, but, because of its cumbersome shape, has not found favor with many dentists. (Fig. 5.)

Figure 6 illustrates a suggestion of Dr. Dowd of Cleveland, who waxes

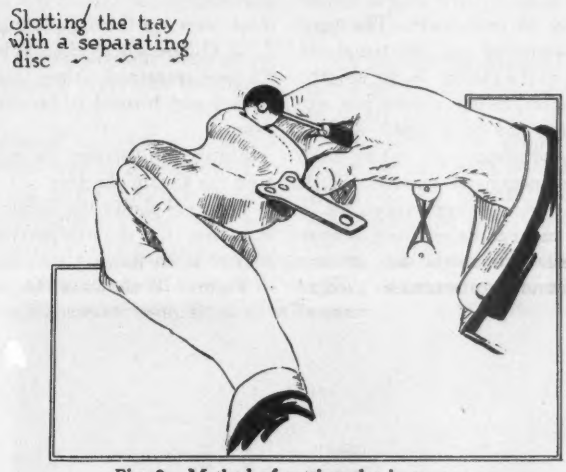


Fig. 8.—Method of cutting slot in tray.

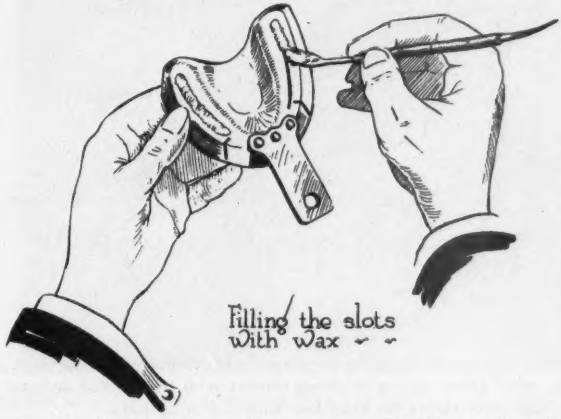


Fig. 9.—Application of soft wax over slots to prevent liquid paste from flowing through.

pasteboard pieces to the floor of the tray to determine the line of cleavage. The difficulty with this principle is the tendency of the pasteboard pieces to get lost in the plaster and shift from their attachment on the tray.

Acting on Dr. Dowd's suggestion, I developed the slot in the tray method, through which a blade can be passed before the impression plaster has thoroughly set, and thereby the line of cleavage be determined. Templates of aluminum or copper may be cut to fit the spaces between the teeth. These templates may be forced through the slot while the plaster is setting, or they may be waxed in position and fitted in place before the plaster is placed in the tray, and then carried to the mouth for the impression. The rigidity of the metal template will

cause the tray to seat itself. The tray may then be removed and the templates left imbedded in the plaster, in the mouth, and when the impression plaster has set, these templates can be gripped with a pair of pliers and snapped off, taking with them a large section of plaster. With little application, an impression for a partial upper case can be removed in four definite pieces, without the loss of any fragments around the teeth to be used as abutments.

most cases are the orthodontic trays Nos. 1 to 11 and 18 to 23. When made of 22-gage material, they can be easily shaped and formed to be adapted to any case.

Figure 8 illustrates the method of cutting the slot in the tray.

Figure 9 shows the application of soft wax over the slots to prevent the liquid plaster from flowing through.

Figure 10 shows a 23-gage template prepared to fit in the space between the

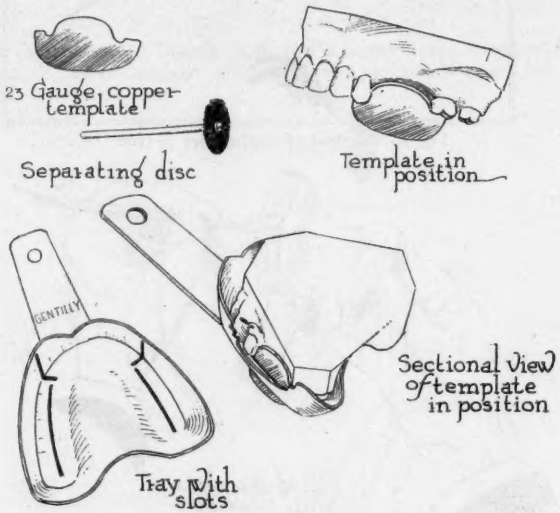


Fig. 10.—Twenty-three gage template prepared to fit in space between teeth, leaving slight space to prevent metal from coming in direct contact with tissues and occlusal rest areas of teeth. The sectional view shows the tray and template in position.

Figure 7 illustrates an ordinary impression tray before and after it has been prepared with slots. These slots are made very easily with a Joe Dandy carborundum disk. They can be placed at any predetermined position. The slots not used should be filled in with wax.

The trays that I employ for partial denture work are made by the Blue Island Specialty Co. of a 22-gage aluminum. The assortment that I find sufficient for

teeth, leaving a slight space to prevent the metal from coming in direct contact with the tissues and occlusal rest areas of the teeth. The sectional view shows the tray and template in position. This slot preparation can be placed on any tray used for full impressions, provided it is of the approximate size.

Figures 11 and 12 show the method of inserting the blade through the wax

and slot into soft plaster for determining the line of cleavage.

Figure 13 shows phantom view of position of blade and tray with the thumb as a guide.

In mass plaster impressions, a proper selection of the tray is important. The ideal tray is one which is light in weight, thin and with sufficient flexibility and rigidity to be shaped and conformed to the case at hand. It should be from an eighth inch to a quarter inch larger than the outline of the arch, so that when it is inserted, it may have an equal distribution of the plaster. This will aid materially in breaking the impression evenly and in very few pieces.

By the postdamming of the posterior periphery of the tray, a rest will be established which will retain it in its desired position.

To prevent the plaster from adhering to the teeth, cold cream or vaselin should be thinly applied. The lips should also be lubricated. The grooves on the tray are seared over with wax and the plaster mixed to the proper consistency and flowed into the tray. Experience alone can determine the exact amount of plaster to be used in the tray for the case at hand.

Fig. 11.—Method of inserting blade through wax and slot into soft plaster for determining line of cleavage.

The object of the slotted tray is to determine in the soft plaster, immediately after the bulk impression plaster is introduced in the mouth, a definite line of cleavage. This is accomplished by the introduction of an instrument of a blade design through the slots while

the tray with plaster is in the mouth and before the impression plaster has set, so that when the plaster has set and the tray is removed, a flat bladed instrument can be inserted in the predetermined grooves. Snapping the instrument will cause the sections of plaster to break at the predetermined registrations, which may be placed at any advantageous position on the tray, producing a minimum number of plaster segments which are to be assembled, thus assuring a more accurate impression than could be obtained if the set plaster had to be cut into and broken away from the teeth.

Fig. 12.—Method of inserting blade through wax and slot into soft plaster for determining line of cleavage.

With the slotted tray, one of three methods can be used to prepare the line of cleavage. First, the slots may be covered with wax and the tray filled with impression plaster. While the plaster is still soft and setting in the mouth, a blunt blade of the right size can be forced through the wax in the slot and worked back and forth to determine the line of fracture. After the plaster has set and the tray has been removed, this same blade is inserted in the grooves provided and a section of the plaster snapped off. A quarter moon shaped spatula blade slightly thinner than the width of the slot in the tray will serve this purpose best. The pointed end of the spatula is inserted through the wax and slot into the soft plaster at a point where it will not interfere with the desired anatomic structure. When the point has touched the occlusal surface or tissue, it is withdrawn about 2 mm. and held in that position with the

thumb as a guide. The blade is then slowly drawn back and forth until the plaster begins to offer the resistance of setting. It is then removed. When the plaster has set sufficiently, the tray is removed and the curved end of the spatula is introduced into the groove of the plaster and snapped. This provides separation at those points where cleavage has been predetermined, as the grooves in the plaster

template replaced in the plaster. With a little lateral pressure, the section of plaster will snap off more easily than in the former method.

In the third method, the templates are waxed on the tray in position from the outside before the impression is taken. When the plaster has set, the wax attachment to the template is removed and the tray withdrawn, leaving the template

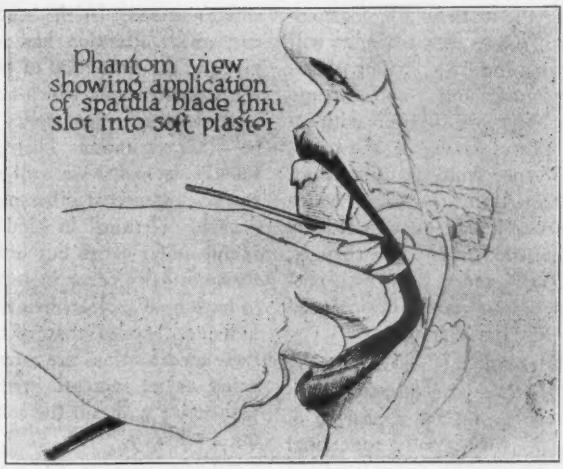


Fig. 13.—Phantom view of position of blade and tray with thumb as guide.

are obtained through the slots made in the tray. The slots in the tray allow the introduction of the blade to any depth, and where spaces occur between the teeth, the blade can be inserted deeper into the plaster. This method practically separates the plaster before the tray and impression are removed.

The second method is one employing a prepared template, which is forced through the slot while the plaster is still soft and left there until it has set. The template and tray are removed and the imbedded in the plaster. Snapping these templates with a pair of pliers will cause the plaster to break along the full line of the template. This method will give fewer and complete sections of plaster to assemble. These sections will fit back in the tray and show an impression that is not marred by the loss of small pieces that cannot be replaced.

The use of this slotted tray has enabled me to make some exceptionally good impressions.

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POSTERUPTIVE CHANGES IN THE MATURATION OF TEETH*

By THEODORE B. BEUST, D.D.S., Louisville, Ky.

THE dental tissues, taken individually, have been made the object of exhaustive research; yet there has never, to my knowledge, been an attempt made to study the tooth as a biologic entity. The hard tissues of a tooth, as will be shown experimentally, adapt themselves to their environment and undergo withal a functional modification with increasing age. In other words, the tooth, after its emergence from its follicle, undergoes certain transformations which soon differentiate it in density or texture from its earlier condition. These changes, which must be regarded as growth phenomena, may appropriately be included under the term "maturation."

Logically, we should expect changes in teeth to develop concurrently with the changes evidencing age appearing in other tissues. Microscopically, functional changes marking posteruptive maturation may, in the earlier stages, be demonstrated in the enamel rod-substance; later, in the order named, in the enamel interprismatic substance, in the enamel tufts, in the dentinal ground substance, in the tubules, in the cementum and, finally, in the pulp.

Owing to the boundlessness of this subject, I must limit my remarks today to the dentin, in which the nature and extent of the modifications are most easily comprehended. In the study of this tissue, much attention has formerly been given to the formation of transparent, or translucent, zones, which appear as localized areas of transparency under caries or other irritation. Disregarding these for the moment, we will call attention to the existence of other metamorphoses, probably identical in kind to the zones found under caries but differing in that they normally occur in teeth not known to have been subjected to visible extrinsic influence beyond that of function. As these modifications are attended by hardening or an increase in density of the tissues, we will call the condition resulting a sclerosis.

The views expressed in this paper were anticipated in a paper read at the 1930 A.D.A. meeting at Denver, entitled "Reactions of the Dentinal Fibril to External Irritation,"[1] in which I subscribed to the view that irritation caused localized reactions which, even in young teeth, resulted in obliteration of the dentinal tubules, whereby the condition of transparency is created. In this obliteration process, the permeable, sievelike structure of the dentin is converted into a tissue which, according to Miller, exhibits re-

*Work supported in part by a grant from the American Dental Association.

*From the Research Laboratory of the School of Dentistry, University of Louisville.

*Read before the Section on Biologic Sciences and Research at the Midwinter Clinic of the Chicago Dental Society, Feb. 4, 1931.

1. Beust, T. B.: J.A.D.A., 18: (June) 1931.

sistance to acids and, according to my staining experiments, refuses the ingress of ordinary staining reagents. To instruct those who may not be intimately acquainted with the tissues under discussion, a diagram of a cube of dentin (Fig. 1) is here shown as a transparent object. The letters *N*, *ST* and *SO* picture three of the numberless tubules ordinarily found in such a block. Tubule *N* contains a protoplasmic fibril. This is the primitive condition. In this state, the tubules, with their contents, will absorb

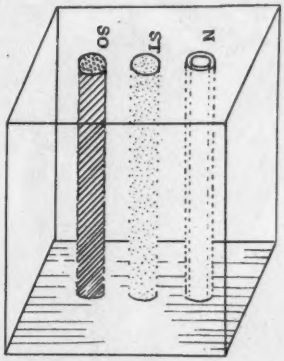

Fig. 1.—Cube of dentin shown as transparent object. *N*, tubule with fibril; *ST*, tubule containing transparent deposit; *SO*, tubule containing opaque deposit.

and conduct stains, even carrying them into the enamel. Compare these to the tubules shown at *ST* and *SO*. Imagine these filled with a deposit which renders the tissues impermeable. As I am assuming that the matter deposited is largely calcific, the application of the term sclerosed to dentin so modified appears justified.

This diagram may also serve to illustrate another important point. Tubules obliterated by depositions of ground substance or by a material approximating the optical density of the ground dentin substance may become invisible, or nearly so, representing the so-called translucent, transparent or hyaline dentin (*ST*, Fig. 1); or the matter deposited may break the light rays completely or refract them so markedly that the sclerosed area may become more opaque than unmodified dentin (*SO*, Fig. 1). The latter form will be referred to hereafter as sclerosed opaque dentin. We are now in a position

Fig. 2.—Stained hypoplastic molar. *SO*, opaque sclerosis; *ST*, transparent sclerosis; *M*, mixed sclerosis. (Photographed by transmitted light.)

to differentiate three kinds of dentin, the primitive unmodified, the sclerosed transparent and the hitherto little-mentioned sclerosed opaque. To these, we may add yet a fourth modification, such as commonly makes up the dentin of the teeth of adults and consisting of combinations of the three.

The technic for the demonstration of modified dentin was evolved after con-

siderable experimentation. It embodies both staining and special photographic methods, an account of which will be appended when this paper is published.

With the help of a fuchsin-stained ground section of a hypoplastic third molar (Fig. 2), I will endeavor to illustrate the occurrence, side by side, of different modifications of the dentin. The knowledge gained in the study of this tooth, we will apply when estimating the changes that occur in sound teeth. Owing to the almost complete absence of enamel,

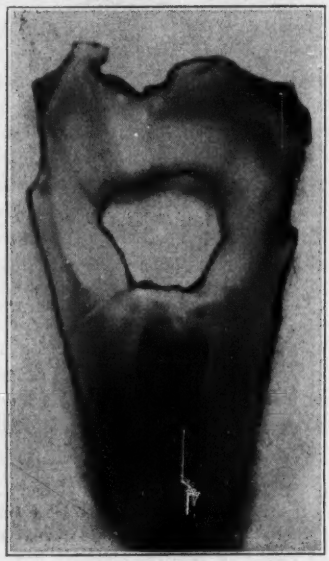

Fig. 3.—Section (Fig. 2) placed on white paper and photographed by reflected light.

the dentin of this tooth was subjected to probably all of the irritations known to teeth, such as exposure to temperature, abrasion, film and chemicals. In fact, if we assume that dentin is at all capable of reacting to irritation, we would have little reason to expect normalcy in any part of its crown. The photograph was taken by transmitted light, which is the common mode of illumination used by dental histologists. I wish to emphasize that relatively few ground sections have ever been observed by other sources of light, a fact which has given rise to certain misconstructions. First, I will call attention to the areas of dentin marked *SO*. These, shown as we are now observing them, resemble dentin modified by caries. Indeed, areas similarly affected have often

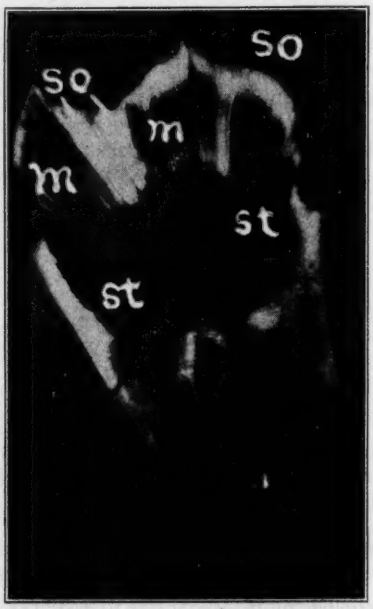

Fig. 4.—Section (Figs. 2-3) placed on a black background and photographed by reflected light. *SO*, opaque sclerosis; *ST*, transparent sclerosis; *M*, mixed sclerosis.

been mistaken for dead or carious tissue. Note that the shadows extend down to the pulp.

We will further examine the transparent area surrounding the proximal and radicular walls of the pulp cavity marked

ST. At letters *M* may be seen areas intermediate in density which are not so opaque as the areas at *SO* nor so transparent as the extensive zones marked *ST*. We will now proceed to place the section from which this photograph was made on a piece of white paper and photograph it by reflected light. (Fig. 3.) It will now be seen that the dark areas on *SO* in the foregoing picture were neither stained nor darkened by caries, that the semiopaque zones *M* consist of transparent intermingled with opaque sclerosed tissue and that the transparent areas marked *ST* are really transparent, the white background being plainly visible through them.

We will now place the same section on a black background and photograph it by reflected light (Fig. 4). This procedure brings out the sclerosed opaque areas, as these photograph white. It also discloses the transparent areas as these now permit the dark background to be seen through them. *M* shows the zones of variegated tissue where the white opaque sclerosed fibrils are intermingled with transparent or semitransparent dentin.

It must not be inferred that all of the tubules in sclerosed opaque or sclerosed transparent dentin are involved. In this connection, it is important to note that while the bulk of the tubules are affected, the pulp, as long as remnants of it exist, may retain its connection with the tooth periphery. I have considered this matter more fully elsewhere.[2] In fact, this tooth, which in its structure exquisitely demonstrates the provisions for its defense adopted by Nature, was, according to W. M. Randall, to whom I am indebted for the specimen, acutely sensitive to the common irritations.

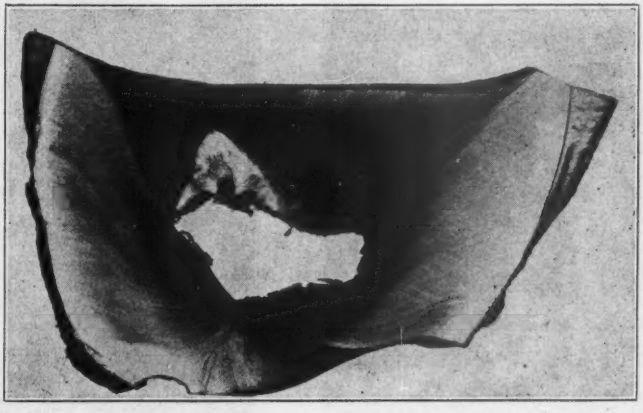

Fig. 5.—Specimen of an abraded molar ground and stained in author's laboratory by M. Elliott, of the Forsyth Dental Infirmary. (Photograph by transmitted reflected light.)

How are we to determine that dentin which is here termed sclerosed has really had its tubules rendered impervious by deposits in their lumen? The answer is: by exposing a tooth, or sections of a tooth,

2. Beust, T. B.: Physiologic Changes in the Dentin, J. Dent. Res., 9:267 (April) 1931.

to the prolonged action of appropriate staining fluids. After twenty years of experience in the staining of teeth, I can positively state that unaffected tubules will conduct stains with avidity and, conversely, that tubules filled with deposits or otherwise obliterated fail to do this, even if sections are so cut that the open ends of each individual tubule are exposed to the stain.

It follows that young unaffected dentin will stain while sclerosed dentin will not. These facts enable us to determine the state of development of the tissues of a tooth by noting its permeability to stain. It will be seen that this test is applicable

Fig. 6.—Section of molar shown in Figure 5, photographed by reflected light.

not only to the dentin but to the enamel and cementum as well.

Another stained specimen exhibiting tubule obliteration is shown in Figure 5. This tooth is seen to be much abraded and the worn morsal surface has been well reinforced by a large area of resistance. Such resistance zones ordinarily develop where abrasion occurs. The closure of the tubules reduces the rate of abrasion, sensitiveness to friction and thermal shock. This is a transmitted light photograph and the sclerosed dentin casts a shadow. Beneath the opaque part, a transparent area may be seen. In the neighborhood of the pulp, a sufficient number of open tubules have absorbed stain to darken the tissue macroscopically. The majority of these extend only a short distance into the dentin.

Beyond the macroscopically stained zone, stained tubules can be traced out into the tissue, where they become more and more contracted and finally disappear, having gradually given place to a zone which becomes increasingly transparent before the transparent periphery is reached. It may be well to remind you again that the staining process to which this tooth has been subjected would have been sufficient to stain the dentin of an

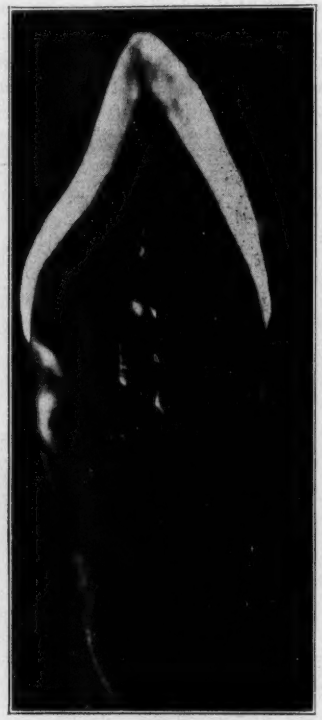

Fig. 7.—Stained tooth of a 13-year-old girl. (Reflected light.)

unmodified tooth clear to its periphery. It follows, therefore, that the tubules of this tooth crown were largely obliterated in the near and abraded portion by opaque deposit; in other portions, by transparent deposit. A study of changes of this char-

Fig. 8.—Stained tooth showing a stage in sclerosis.

acter has never, to my knowledge, been undertaken.

We will now check this specimen by placing it on a dark background and making the examination by reflected light (Fig. 6).

It will be seen that the sclerosed opaque area under the morsal surface is not brown, as may have been inferred from the preceding illustration, but white. As the background now shows through the transparent parts, the transparent area over the pulp cavity appears dark. The stained tubules in proximity to the pulp, of course, appear dark, as before.

Fig. 9.—Stained molar showing advanced sclerosis.

Before passing the preparations thus far shown, I would have you grasp the principles of caries resistance exhibited where teeth, although robbed of their enamel through hypoplasia or traumatism, stay immune. You must also realize that we are here dealing with manifestations of stimuli comparable in kind with those increasing the deposition of keratinous material on palmar surfaces when

these are subjected to added stress or to strengthening of the osseous system of parts delegated to bear continued strain.

We have thus far considered reactions to stimuli. We have seen teeth, denuded of their enamel, develop resistance areas or zones to combat the action of trauma. From this reaction, of which numbers of examples could be provided, it must be inferred that resistance to decay lies within the tooth itself. This is a statement which I supported, when writing on the enamel, twenty years ago.[3]

I am aware that many regard the changes here noted, that is, the increased deposition in the tubules, as a pathologic phenomenon. I have considered this matter elsewhere, but would here emphasize that while the end-result may possibly be the same, in the pathologic sense we would have, first, death of the cytoplasmic tubule content, followed by calcification; whereas, in the biologic sense, we would have stimulation followed by physiologic conversion of the tubule content into the ultimate state of development.

For twenty years, I have given attention to the staining of sound teeth. My object heretofore has been to secure stained specimens of enamel for study. At the outset, I found that the dentin of many of my specimens refused to stain—in other words, were impervious to dyes. Numberless such chromophobic teeth were formerly discarded as unsuited for my purpose. Experience brought the realization that these were nothing more or less than teeth that have arrived at their full development. To contract the facts into a simple statement we may say that the hard tissues of young sound teeth are permeable to dyes, a condition gradually and steadily decreasing with increasing age. This statement in itself indicates that the calcification of tubules is physiologic, that the gradual elimination and calcification of odontoblastic fibrils by the normal contraction of the pulp cavity is identical to that occurring under abrasions.

As an example of a permeable tooth, observe a cuspid of a 13-year-old girl (Fig. 7). Visible modifications, as seen near the neck of this tooth, are already demonstrable at this age. A transitional stage may be studied in Figure 8, in which relatively few strands of sclerosed tissue have appeared. A late stage will be seen in Figure 9. Here, we find strands of impermeable (sclerosed) tissue pervading all regions of the teeth.

The conclusions from these studies justify the view that the hardening of the teeth observed in all of the cases shown is a biologic phenomenon indicating the presence of powers of resistance within the tooth.

3. Beust, T. B.: Dent. Cosmos, 54:659 (June) 1912.

ROENTGENOGRAPHIC EXAMINATION OF DENTAL GOLD ALLOYS

By JOHN S. SHELL, B.S., and
DONALD McCORMACK, San Francisco, Calif.

THE advantages of a nondestructive method of examining dental restorations for imperfections are obvious. Microscopic examinations usually involve the sectioning of the specimen, thus destroying it for further use. Mechanical tests are almost universally destructive, and seldom can they be applied to specimens of dental dimensions. Alternating flexure tests have been made directly on cast clasps, but, to be of value, they must be continued until the structure fails.

The examination of metals by means of roentgen rays, now a routine procedure in many industries, is particularly valuable if imperfections may be produced during the process of construction. Castings and welded joints are especially subject to the occurrence of pits and flaws that are quite easily detected by roentgenographic methods.

Dental restorations demanding the use of metals are subject to the type of imperfections that can readily be detected by such examinations. Pits, so common in gold alloy castings, have less resistance to the passage of roentgen rays than the solid metal and so appear black on the negative. As the pictures shown here are prints of the negative, the less dense portions appear lighter in the reproductions.

Roentgenographic examination of test specimens before subjecting them to the various physical tests is also of considerable value in dental gold alloys. Tensile strength tests are meaningless when the test specimen fails, because of pits or imperfections in the casting. Such imperfections can be shown by roentgenographic methods before the specimen is tested, and a combination of a roentgen-ray test with the physical tests of the same casting would be much more informative.

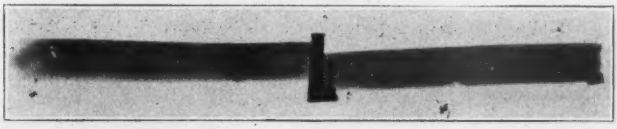

Fig. 1.—Gold alloy casting 0.02 by 0.25 by 3 inches (positive print).

A flat specimen 0.02 inches thick, 0.25 inches wide, and about 3 inches long was cast in a centrifugal casting machine, an alloy recommended for one piece casting being used. A roentgenogram, taken in two sections covering the entire length of the specimen, was obtained, a positive print of which is shown in Figure 1. The

dark band in each section is caused by the same feather edge on the casting, resulting from a crack in the investment. This excess metal which is not penetrated so easily by the rays appears lighter on the original negative and consequently darker in the picture. The lighter portion, near the center of the specimen, which extends almost throughout the entire length, indicates the presence of a large number of fine pits. Figure 2 shows a

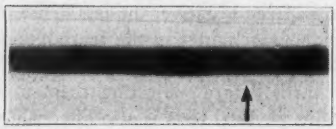

Fig. 2.—Gold alloy casting 0.04 inches thick (positive print).

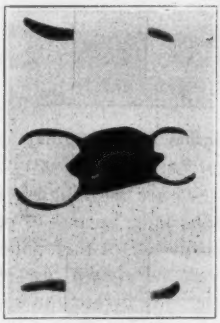

Fig. 3.—Complete one piece casting with pictures taken through individual clasps (positive print).

section of a casting of the same alloy 0.04 inch thick. A series of localized pits near one end of the print is shown by the lighter portion in the figure. This specimen was placed in a tensile strength testing machine and fractured at the point indicated by the arrow.

Figure 3 shows a roentgenographic study of a unit casting consisting of a saddle with four clasps. The central outline picture is included to indicate the type of restoration and the location of the clasps shown in the adjacent roentgenographic reproductions. Roentgenograms taken through the side (the thinnest portion) of each individual clasp are also shown. Each of the prongs show evidence of imperfect structure, and the molar clasps are decidedly pitted. Figure 4, a side view of the same restoration, indicates the orientation and magnitude of the pits.

Fig. 4.—Complete one piece casting, side view (positive print).

The application of roentgenographic tests to metals used in dental restorations, especially to castings and soldered joints, seems possible. Wrought metals in the form of plate or wires are also susceptible of roentgenographic analysis. Such examinations are relatively simple and are an ideal means for predicting the durability and value of dental restorations when they are dependent on metallic materials for strength.

WHAT SCIENCE DOES NOT EXPLAIN*

By J. E. SCHAEFER, M.D., D.D.S., Chicago, Ill.

BECAUSE medical and dental students are introduced to a maze of phenomena relating to living matter, some based upon factual observations and some resting on broad hypotheses, they are likely to become confused in their thinking and jump to the conclusion that medical science represents the sum total of knowledge. It seems to them that all phenomena can be explained on the basis of definite fixed laws. They are likely to acquire a feeling of self sufficiency because they have accumulated a smattering of knowledge of what is designated as science. And with this mental attitude of self sufficiency, they are liable to annihilate the older conception of a supreme intelligence in the universe, a God, altogether.

It is only after one has digested much of the information given to him in medical school or dental school and has attempted to apply the information in practice that he learns that much which he thought was an absolute science, following definite laws of cause and effect, is not a science at all. And much that one does in the treatment of disease is empiric. True, it may be rationally empiric, being based upon results obtained by clinical experience. One may find that a certain drug seems to be beneficial in a disease and so he gives it. But how can one measure the exact rôle the drug has played? For instance, a patient was turned over to me with multiple abscesses of the cheek following the extraction of a tooth. These abscesses had been drained with no improvement on the part of the patient. When I received the patient, he was running a high temperature with a spreading abscess in the temporal fossa. I immediately instituted through and through drainage of the temporal abscess and followed this with irrigations with Dakin's solution. As the patient did not show much improvement, we reasoned that his resistance was low, whatever that may be, so I had a competent internist prepare and give an autogenous vaccine. He also gave the patient potassium iodid, and because he found a few Vincent's organisms, he gave the patient intravenous injections of neo-arsphenamin. In a week, the man had improved, and he left the hospital. I had him stay outdoors in the sunshine and take a nutritious diet. In about two weeks more, he showed marked improvement, the old sinuses ceased to discharge pus and he was well on the way to recovery. Now, how can one evaluate this improvement on a scientific basis? Was it the autogenous vaccine? Was it the potassium iodid? Was it the neo-arsphenamin? Was it good drainage, or how much of his recovery was due to his own biologic efforts?

Nature has endowed our bodies with wonderful powers of recuperation. Can these be measured by talking about immune bodies or whatnot? No, if we are

*Read before the dental and medical students of Northwestern University under the auspices of the Y. M. C. A.

honest with ourselves, we quickly learn that we cure nothing, that the cure rests in the body itself. By intelligently working with Nature, we may aid in the process of restoration.

Dr. Haggard, of Yale, in his book entitled "Devils, Drugs and Doctors," makes the statement that 90 per cent of sick people get well automatically, whether they are treated by a chiropractor, a Christian science healer or the doctor who appears on the scene and shakes his head seriously, simulating a profound wisdom which he does not possess. So with this approach, let me carry you through my own reactions in this difficult problem of trying to be rational in a world of seeming contradictions.

I came from a small town with the usual orthodox religious viewpoint, to study dentistry. Early in my course, I came under the influence of a teacher of physiology who was convinced that a mechanistic explanation of the universe was all sufficient. He gave us the "nebular hypothesis" of LaPlace as an explanation of the formation of our planetary system. You no doubt are conversant with this hypothesis. It accounts for the state of affairs existing in our solar system by assuming that the material composing the system was originally a mass of intensely hot gaseous matter that tended to assume a rotating, globular form under the action of gravitational forces. Gradually, the mass contracted, and successive rotating rings were from time to time left behind, which, in turn, continued to rotate, each forming a planetary system. Having accounted for the existence of the earth, he then proceeded to explain the presence of human life by the evolutionary theory. Someone has said that a little knowledge is a dangerous thing, and with the self sufficiency of youth, this mechanistic theory seemed to explain all things. But as one grows older, and his experiences of life become deeper, there is much in the universe not satisfactorily explained by any mechanistic theory.

Just now, I am taking an exceedingly interesting course entitled "Contemporary Thought," given in the School of Journalism at Wiebolt Hall. The first half of the course approaches the universe from the scientific viewpoint. I take science to be merely a method of approach, having for its basis a body of knowledge built upon observed facts. Science must necessarily set up hypotheses to explain natural phenomena where there is an insufficiency of factual knowledge. I learned that the "nebular hypothesis" has been replaced by a "planetesimal hypothesis" advanced by Chamberlain and Moulton of the University of Chicago. This hypothesis holds, in the explanation of the formation of our planets, that a dark object approached our sun, not sufficiently close to collide, but close enough to disturb the equilibrium of the sun's mass, causing the latter to bulge, and that probably some of the sun's mass was carried away by the dark object. Because of this disturbance of the sun's equilibrium, other masses were cast off, to form our planets.

Now it does not require any great amount of intelligence to infer that these explanations are highly speculative; for man cannot, with any degree of scientific accuracy, project his mental processes either backward or forward through eons of time, or through to what, in all human comprehension, is endless space.

I was amused by a satirical reference of Shailer Mathews to these astronomic speculations. He told us how he attempted to pin one of his astronomer friends down to a definite statement as to the distance of a certain star from us.

His friend told him definitely that the distance was a given number of light years. Of course, you know the measuring rod of light years is a tremendous one; it is the speed of light of 186,400 miles per second, times 86,400, the seconds in a day, times 365, the days in a year. Shailer Mathews, wishing to verify the distance of the particular star that he was interested in, approached another one of his friends in astronomy. "Is it true that such and such a star is so many light years away?" he asked. The second friend said, "Well, all the first astronomer wished to say was that the particular star was a long way off." Shailer Mathews' comment was that he could have said this in a much simpler way than to have had to calculate the distance in light years.

Mathews then comments on a galaxy and the number of stars in such a group; for instance, the milky way. He says that as nearly as he can find out, the answer depends on whether one is a radical or a conservative. If the former, the number is placed at three or four billion; if the latter, at one or two billion. Then the astronomer goes from a galaxy to a supergalaxy or a grouping of galaxies. Shailer Mathews' comment was that, after he listens to the explanation of these incomprehensible systems, he turns to the contemplation of such a theologic mystery as the Trinity as a simple problem. Now, Shailer Mathews did not have in mind ridiculing the field of astronomy. He merely wished to point out that when man attempts to explain natural phenomena which he has no accurate way of checking, his explanation must necessarily often be highly speculative in character, or, in other words, when science leaves the field where things can be measured or weighed, its answer may be as speculative as religious thought or poetic fancy. Thinkers are now speaking of an "emergent evolution," which is merely an attempt to place various hypotheses in a logical sequence. Having explained the formation of the physical world, the next transition is to pass from this inorganic state to the organic phenomena of life, and, from life, the emergent evolutionist passes to the explanation of mind. He then arranges his materials in the logical sequence of matter, life, mind.

Let us proceed to analyze the explanation of the origin of life. Protoplasm or living matter is composed chiefly of the elements of carbon, hydrogen, oxygen and nitrogen. Now, the idea is that, sometime and somewhere on this planet of ours, these elements, under favorable conditions, were arranged in a colloidal mass, from which life sprang.

To me, the assumption that unintelligible matter had the intelligence to evolve itself into life and then into human mind is far from a satisfactory explanation. I was pleased to hear Professor Burt of the University of Chicago point out that such an assumption was illogical unless we attributed to these elements some inner urge.

The Germans have produced a cinema called "Mother Nature," presenting natural phenomena in a logical sequence so as to suggest the story of evolution. They have the intelligence to attribute to these phenomena a creative urge. Let us for a moment consider a tiny bit of life, the human fertilized ovum, a thing smaller than the point of a pin, a thing so fragile that it could be crushed with the pressure of a finger. We stain it, and learnedly talk of the hereditary carrying power of the chromosomes, but who can explain the infinite mystery of its physiochemical nature? If one permits his imagination to play for a mo-

ment, he can see here in this tiny nucleus of matter a personality—perhaps a great personality—one with the moral courage of a Lincoln, or the poetic fancy of a Shakespeare or a soul of a Beethoven who shall produce music so sublime, that, as Carlyle has suggested, it may carry us to the brink of the infinite and for a moment allow us to gaze beyond. No, it takes a more profound explanation to clarify these things than the theory that blind bits of elementary matter had the intelligence to bring that mystery, the fertilized ovum, into being.

I have the greatest admiration and respect for scientific thought and achievement, but we must recognize that science has its definite limitations. It never can explain the ultimate of all things. Let me suggest how easy it is to come to the limits of scientific knowledge. I will point out two instances in my own field. I do considerable work with bone infection and cancer. Now, one cannot handle bone infections intelligently unless he has some knowledge of bone and its reparative possibilities. A bone is a most interesting connective tissue because of its calcific nature. How do we approach the study of bone? First, we kill it; then, we decalcify it, then stain it. We then attempt to interpret its physiologic activities by studying its cellular nature. We describe osteoclasts and osteoblasts. We read into these cells certain activities, but, all the time, we are looking at dead cells; for it is not physically possible to study these activities in a living state. Here, we at once meet a physical handicap which our science is unable to surmount because of the nature of the problem that we have before us. But let us assume that we could submit living bone to microscopic examination, as we can watch the inflammatory reaction of a frog's mesentery in the living state, by placing it on the stage of a microscope while it is still attached to the living specimen. If it were possible to do this with bone in order to watch its cellular activities, we would still be confounded by chemical processes taking place in bone. We attribute to the osteoblasts the power of building bone and to the osteoclasts the power of destroying bone, but both of these processes require that the minerals calcium and phosphorus must, on the one hand, be deposited by tissue fluids into the bone in some way, or if the bone is being destroyed, the same minerals must be dissolved out in some way, that they, in turn, can go into solution and be carried away by the body fluids.

Here is an important subject in the field of medicine, and yet our physical and chemical methods are totally inadequate to explain certain important phenomena. I could develop the theme of cancer in the same way and show you how superficial and inadequate our knowledge is of this disease process which is killing mankind by the millions. Just recently, I removed one-half of a man's lower jaw by the most approved surgical methods, that is, by surgical diathermy followed with massive doses of radium. I have carried this man almost to the brink of his grave by a heroic surgical procedure, and yet I have no assurance of a cure. Cancer in an advanced state defies all the scientific knowledge and procedures known to the medical profession. When a Marconi can sit in his yacht off the peninsula of Italy, and, by an electrical device, express his will 10,000 miles away in Sidney, Australia, by lighting lights in that city, we bow in profound admiration to the achievements of human intelligence. But what has Marconi done? Nothing more than interpret a bit of the natural order of things. He has not produced the physical laws of the universe,

without which he could not send his wireless message. No, they have been in existence since the dawn of creation. They are a part of the mystery of power about us which we can never fully comprehend. I recall spending an evening in one of the divinity halls while attending the University of Chicago, listening to Shailer Mathews discuss questions with his divinity students. He said that primitive man saw a god in everything about him, in the lightning, in the storms, in the rivers and the seas and in many other inanimate and animate objects. As man progressed and began to understand these natural phenomena, he removed them from this mystery of power and placed them on a basis of factual knowledge. But there always remains a great reservoir of this mystery of power which man cannot comprehend, and, out of this, man has created his gods. There remains and always will remain much to be explained, much that cannot be reduced to the basis of scientific observation, and so we must leave the scientific approach behind and seek the answer in the field of philosophic speculation. Eternally in the human breast is the desire to know, to comprehend, to explain this mystery of power in the universe, and so each thinking man in his own turn fashions and attempts to explain his own God.

For a long time, I could readily understand God in the physical world. No one can gaze into the depths of the Grand Canyon without a feeling of awe, without the reaction that here is something man could not fashion, nor at the summit of a lofty mountain peak without being inspired by its massiveness, without being impressed by his own physical insignificance. I think the finiteness of man is beautifully described by Victor Hugo in his "Les Miserables." Permit me to quote from him.

THE WATERS AND THE SHADOW

A man overboard:

What matters it; the ship does not stop. The wind is blowing, that dark ship must keep on her destined course. She passes away.

The man disappears, then reappears, he plunges and rises again to the surface, he calls, he stretches out his hands, they hear him not; the ship, staggering under the gale, is straining every rope, the sailors and passengers see the drowning man no longer; his miserable head is but a point in the vastness of the billows.

He hurls cries of despair into the depths. What a spectre is that disappearing sail. He looks upon it, he looks upon it with frenzy. It moves away; it grows dim; it diminishes. He was there but just now, he was one of the crew, he went and came upon the deck with the rest, he had his share of the air and of the sunlight, he was a living man. Now, what has become of him? He slipped, he fell; and it is finished.

He is in the monstrous deep. He has nothing under his feet but the yielding, fleeing element. The waves, torn and scattered by the wind, close round him hideously; the rolling of the abyss bears him along; shreds of water are flying about his head; a populace of waves spit upon him; confused openings half swallow him; when he sinks he catches glimpses of yawning precipices full of darkness; fearful unknown vegetations seize upon him, bind his feet and draw him to themselves; he feels that he is becoming the great deep; he makes part of the foam; the billows toss him from one to the other; he tastes the bitterness; the greedy ocean is eager to devour him; the monster plays with his agony. It seems as if all this were liquid hate.

But yet he struggles.

He tries to defend himself; he tries to sustain himself; he struggles; he swims. He—that poor strength that fails so soon—he combats the unfailing.

Where now is the ship? Far away yonder. Hardly visible in the pallid gloom of the horizon.

The wind blows in gusts; the billows overwhelm him. He raises his eyes, but sees only the livid clouds. He, in his dying agony, makes part of this immense insanity of the sea. He is tortured to his death by its immeasureable madness. He hears sounds, which are strange to man, sounds which seem

to come not from the earth, but from some frightful realm beyond.

There are birds in the clouds, even as there are angels above human distresses, but what can they do for him? They fly, sing and float, while he is gasping.

He feels that he is buried at once by those two infinities, the ocean and the sky; the one is a tomb, the other a pall.

I said that I could readily comprehend God in the physical world, but how to comprehend him in the moral world, the world of human activity, was more difficult. And not until I read Durant's "Story of Philosophy," and contemplated the majesty of the human mind and human thought as depicted by the great thinkers of all times did a plausible explanation of the God substance at work in the human breast dawn on me. In reading Durant's book, the story of Spinoza interested me greatly. As you know, the Jews were driven from Spain by religious persecution and found a haven of refuge in Holland. Here, young Spinoza began to ponder on certain orthodox religious principles, he began to question them. The Jews became frightened because his attack might be interpreted by the Hollanders as disturbing to their religious teachings. So young Spinoza was called into the synagog and asked to recant. He refused. As was their custom, he was placed on the floor of the synagog, spat on, cursed and cast out from his own people. He found a home with a family of Dunkards, a religious sect; ground lenses, and eked out a bare existence so that he might devote his energy to recording his philosophic thought. He died in his early forties from consumption and overwork, but recognized as one of the great thinkers of all times.

One could enumerate personality after personality down through the ages, men whose lives have been an inspiration to all mankind. But one cannot pass over the history of our Western civilization without considering a personality that transcends them all, and that is the personality of Jesus Christ. I shall quote a short passage from "The Outline of History," to give you Wells' interpretation of the message of Christ to the world.

The doctrine of the Kingdom of Heaven, which was the main teaching of Jesus, and which plays so small a part in the Christian creeds, is certainly one of the most revolutionary doctrines that ever stirred and changed human thought. It is small wonder if the world of that time failed to grasp its full significance, and recoiled in dismay from even a half apprehension of its tremendous challenges to the established habits and institutions of mankind. It is small wonder if the hesitating convert and disciple presently went back to the old familiar ideas of temple and altar, of fierce deity, and propitiatory observance, of consecrated priest and magic blessing, and—these things being attended to—reverted then to the dear old habitual life of hates, and profits and competition and pride. For the doctrine of the Kingdom of Heaven, as Jesus seemed to have preached it, was no less than a bold and uncompromising demand for a complete change and cleansing of the life of our struggling race, an utter cleansing, without and within.

Here, then, is the answer to me of God at work in the moral world, through the agencies of human personality. All that is noble in human effort, all that is sublime in human sacrifice, all that is sacred in human love is but an expression of the divine will.

One cannot escape the consequences of his acts, one cannot violate physical, moral or spiritual laws without reaping a harvest of retribution. That we cannot measure or weigh moral and spiritual things in a physicist's laboratory does not make them any the less real. I do not believe that any intelligent man can escape from the divine in the universe. I do not believe that a scientist can peer into a microscope without recognizing divine intelligence as expressed in all things.

I have completed the argument as it appeals to me. Shailer Mathews' expression of the purpose of religion seems appropriate. It is the adjustment of ourselves to the physical, moral and spiritual laws in the universe, to be attuned and in harmony with all righteous things. Violation of these laws means disharmony or a pulling back, or a dragging down, from achieving that which is noblest and loftiest in each aspiring soul.

TRAUMATIC OCCLUSION THE ETIOLOGIC FACTOR IN PYORRHEA*

By R. MORSE WITHYCOMBE, Sydney, Australia

DR. MACMILLAN has written a very able paper, calculated to have a powerful influence on dentists who have not much time to acquire experience in relation to periodontal lesions.

Having for the past thirteen years advocated and practiced the correction of traumatic occlusion in the treatment and prevention of pyorrhea, I hope that my matured opinion resulting from experience and from most careful observation of facts will prove of value to those members of the profession who are anxious for the truth.

Traumatic occlusion is either the predominating etiologic factor in pyorrhea, or it sinks into a comparatively insignificant position, ranking with other agencies which speed the progress of the disease. In other words, it is a condition of elongation of one or more teeth, which has always called for and received more or less adjustment.

The question is, can a condition producing incorrect function of the teeth, which is essentially traumatic occlusion and which has been creeping insidiously on our race until we find a large majority of school children affected by it, really be the instigating cause of pyorrhea?

Let us commence at the beginning. Paleodontologists tell us that man probably evolved from the anthropoid ape, a million years ago. This infers that the broad sweeping dental arch of modern man, with its vigorous lateral swing of the mandible under masticating pressure, has for a million years taken the place of the narrow arch of the anthropoid ape with its anteroposterior movement only.

The transverse occlusal curve in man has its convexity downward, while, in the ape, it is the reverse, having its convexity upward. Man has synchronously evolved the erect posture of the body and the lateral excursion of the mandible, and he may as well endeavor to revert to all fours and grovel with the beast as to expect to succeed in reverting to the plane of occlusion of the teeth, characteristic of the ape, i. e., the "anteroposterior."

And yet it is just this that our young people are attempting today. I recently examined 100 high school boys in order to ascertain how many had developed normal use of their teeth. One boy only was normal, and, as might be expected,

*An answer to a paper entitled "The Case Against Traumatic Occlusion" by H. W. MacMillan, which appeared in the November, 1930, issue of THE JOURNAL.

he was not only free from caries and signs of periodontal disease, but was also physically a nearly perfect specimen. Four per cent had unilateral masticatory function established, and normal gums. The remaining 95 per cent of these boys had the teeth hopelessly locked in the attempt to pass into lateral excursion, by the right and left lower cuspids fouling the upper. The gateway being blocked to right and left lateral excursion, all of these boys are doomed, without correction of occlusal stress, to restriction to a modified anteroposterior movement in mastication, which gradually increases as the upper anterior teeth are forced out of the mouth by the protrusive pressure of the lower anterior teeth.

This perversion of function causes a jar to the teeth, which we term traumatic occlusion, but it is evident that the amount of stress exerted is of little significance, because many slight jars soon aggregate a heavy one. When the truth is grasped that "traumatic occlusion" is not a plus occlusion but a perversion of occlusion or an incorrect functional activity of the teeth, such criticism as that of Dr. MacMillan will lose its sting, because the bulk of his attack lay in ridiculing the idea that an excess of masticating stress could cause disease in or around a normal tooth.

To return to the ninety-five unfortunate boys: all of them exhibited early indications of periodontal disease, and twenty-five had acute gingivitis, well manifested, with hemorrhage.

The only function these boys had any definite instinctive idea of was in centric occlusion, and some of them could well emulate the snapping bite of the rodentia. The curious feature about this condition is that, in centric occlusion, the teeth are in correct relationship, and when the swing of the mandible is attempted, it becomes apparent that the transverse occlusal curve is shortened, so that the cusp of the lower cuspid, instead of passing through the space between the upper cuspid and lateral incisor, strikes the cuspid and the movement is thus definitely impeded. The shortening of the transverse occlusal curve is probably the result of a lack of exercise of the muscles controlling the mandible during the early period of life.

I also recently examined fifty persons at a Seventh-Day Adventists' camp, and found only one, a boy, aged 18, with normal masticating occlusion. He, like the high school boy, had perfect teeth, gums and constitution.

Dr. MacMillan declares that traumatic occlusion does not occur in the carnivora and other lower animals, and reminds us that the careful coordinating of opposing occlusal surfaces was not one of the selective methods employed in the development of this most efficient machine.

It should be unnecessary to remind Dr. MacMillan that the carnivora are as far from the omnivora as the poles are apart. The former rend, tear and bolt their food, without any preparation for digestion. There is no lateral mastication indicated or required in the sharp incisive action of a dog's teeth, but man has an omnivorous masticating machine with which he needs must grind his food in preparation for salivation, assimilation and digestion.

In correct human function, teeth grip teeth with contact surfaces worn, and in the same plane. It is this functional activity which has come down the countless ages and made us what we are, and we needs must retain it or degenerate.

I have had a patient under observation for over twenty-five years for whom I have extracted all the teeth except a

lower cuspid. This cuspid was shell crowned without devitalization and the cusp flattened to about an angle of 20 degrees, the upper denture being adjusted to occlude in the same plane with this tooth.

For twenty-five years the patient has refused to wear a lower denture and has masticated and his jaws have functioned perfectly with this single tooth, he enjoying the best of health.

A few months ago, the tooth decayed below the cervix and broke off. Indigestion then set it, but disappeared when the shell crowned tooth was readjusted by means of a post inserted in the root. This would appear to be strong evidence in favor of the occlusal masticating function advocated in this paper.

Dr. MacMillan declares that a perfectly healthy tooth could not deteriorate through traumatic occlusion. I reply: If, during lateral excursion of the mandible, the teeth jar instead of rubbing each other, the healthiest periodontal tissue, both bony and fibrous, will in time lose its vitality and invite infection, which is ever present in the mouth.

Dr. MacMillan also asks the following pertinent question: "If traumatic occlusion comes so close to being a specific cause of pyorrhea, why does its removal alone not effect a cure?" I reply: In thirteen years, I have treated more than 3,000 cases of periodontoclasia of more or less severity. The ages of the patients have ranged from the youngest of children to the oldest adults. A considerable portion of these cases have been treated by correcting the occlusion only, with a view to eliminating traumatic occlusion and obtaining powerful normal masticating occlusion. It is rarely that I give any other treatment to young people under 18 years of age, other than to advise them regarding oral hygiene; and, in some most advanced cases, when calcific deposits have been absent, permanent cures have resulted without surgical interference to the periodontal pockets. Dr. Box, in his excellent textbook, "The Treatment of the Periodontal Pocket," urges us not to change the gingival sky line by surgical procedure, until the involved teeth have been brought into a state of physiologic rest and the result observed.

Another of Dr. MacMillan's definite statements is as follows: "Alveolar border disturbance has never been produced experimentally by placing a perfectly healthy tooth in traumatic occlusion." In reply to this assertion, I venture the opinion that the majority of dentists throughout the world are daily experimenting in this direction, and Dr. MacMillan's paper is calculated to increase the number. Periodontists find an enormous amount of work in correcting the well-meant but faulty occlusion of all kinds of dental restoration, which have and are producing traumatic occlusion.

Finally, the charge by Dr. MacMillan that gnathologists (as Ottolengui in *Dental Items of Interest* has somewhat facetiously termed us) are doing distinct harm will probably help to discourage those practitioners who are trying to do something along scientific lines.

An authority has declared that: "In order to be of evolutionary value, ideas and practices that are found to be endowed with the elements of survival must be worked into the fabric of our professional thought."

In the September, 1917, issue of the *Commonwealth Dental Review,* a paper is published which was read by me before the Odontological Society of New South Wales. The following is an extract:

I wish to say in reference to the early causes of "pyorrhea alveolaris," that the one reason which is gripping me more and more

is that of malocclusion. If you ask pyorrheaics to close the bite, you will generally find the teeth come together perfectly in central occlusion; but ask them to swing the mandible into lateral occlusion under pressure, and you will find, in all probability, that they never acquired the habit, and the deep cusps which should have been worn down in early life remain and give a depth of bite which is a continual menace, the teeth bumping and jarring the roots abnormally against the peridental membrane. I wish to advocate the early attention of dentists to this lack of natural wearing of tooth cusps by attrition during mastication, and to urge them to use stones to judiciously assist where the patient has failed, and so open a way for our young people to acquire the full normal exercise of the teeth during mastication, which would go far to prevent the condition of stasis in the tissues which is the forerunner of pyorrhea alveolaris.

Since the date when these words were first read, I have consistently and with much success practiced what Dr. MacMillan calls an hypothesis, and I have received and am receiving most liberal support from members of the dental profession in Australia.

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Editorials

THE EIGHTH INTERNATIONAL DENTAL CONGRESS

The Eighth Congress convened in Paris, Aug. 3-8, 1931, and from all accounts it lived up to the traditions that have been established in previous congresses. The attendance was naturally not so large as on the occasion of the Seventh Congress in Philadelphia, but it was much larger than had been anticipated, making a really remarkable showing in consideration of the industrial unrest the world over. The estimated attendance was about 3,000, and it embraced all the leading nations of the world.

The Congress was opened by the Minister of Public Health, and the presiding officer of the first session was our old friend, Viscount Florestan Aguilar, who introduced the President of the Congress, Dr. Georges Villain.

The meeting convened in the Grand Palais, which provided a most admirable setting for such an event. The different countries presented their reports and scientific exhibits, the whole embracing a very admirable résumé of dental science and art of the present day.

There were sixteen sections, as follows: 1. Anatomy, Physiology, Histology, Embryology. 2. Bacteriology, Pathology, Anatomy. 3. Dental Pathology and Therapeutics. 4. Alveolar Pyorrhea. 5. Operative Dentistry. 6. Physics, Chemistry, Metallurgy. 7. Radiology and Physicotherapy. 8. Complete Denture Prosthesis. 9. Partial Denture Prosthesis, Crowns and Bridgework. 10. Oral Surgery, Extraction, Anesthesia. 11. Dentofacial Orthopedia. 12. Maxillofacial Surgery and Prosthesis. 13. Oral Hygiene; Public Dental Services. 14. Dental Services of the Army, Navy and Air Forces. 15. Dental Education. 16. History, Legislation, Dentology, Professional Press, Documentation.

The scientific exhibits far exceeded anything previously presented, and the national health exhibits were really outstanding. The dental health program, in fact all of those things that had to do with community welfare, were presented in a way never before approached.

Naturally in an environment such as that of the Eighth Congress, the social functions were not only varied but also unique, and the visiting delegations were made to feel that even in a great scientific event of this character, there was room for the normal amount of diversion.

The International Dental Federation (F. D. I.), which is the centralized body, and the one that directs all of the congresses, elected the following executives for the various commissions (in each case, the first-mentioned to act as president):

Education: Villain (H.), Guy, Dubeau, Zilkens, Gilmour, Aguilar, Logan, Turner and Cieszynski.

Hygiene: Linnert, Bruske, Burkhart, Rowlett, Witthaus, Jaccard, Menzies Campbell, Brun and Tholuck.

Scientific: Fish, Gottlieb, Euter, Howe, Villain (G.), Müller, Pichler, Dieck and Prinz.

Press: Joachim, Cohn, Bejach, Brooks, Johnson (C. N.), Aguilar, Roy, Marchadant and Haderup.

Red Cross: Watry, Jaccard, Drexler, Villain (H.), Rowlett, Bjerrum, Piquet, Blum and Giovachin.

Legislation: Gilmour, Fischer, Hoffman, Logan, Villain (G.), Aguilar, Shimamine, Ferraro and Papantonopoulos.

Documentation: Quintero, Weinberger, Alaham, Rebel, Peergad, Huet, Jaccard, Anthony and Brooks.

Terminology: Loos, Anthony, Gottlieb, Fish, Gottlich, Lonnerville, Weski, Roy and Prinz.

Army and Navy: Oliver, Logan, Rosenthal, Radford, Watry, Viau, Chiavaro, Van Hasselt and Witt.

The above-mentioned executives will meet later to select ten additional members to complete each commission.

A very appropriate function was that of paying a tribute to the memory of the late Charles Godon, who was President of the Third International Dental Congress, and who was largely instrumental in organizing the International Dental Federation. At the close of the Congress, Saturday, August 8, a wreath was laid on his grave at the cemetery of Pere La Chaise.

For much of the information contained herein we are indebted to J. Menzies Campbell of Glasgow, who attended the meeting and took copious notes of the proceedings.

The next Congress will be held in Vienna, in 1936.

THE POSSIBLE SOLUTION OF A DOUBLE PROBLEM

There are two problems that stand out most insistently in our profession at this time. One is the ever-present problem of caring for the teeth of the poor, particularly of the children of the poor. It has repeatedly been stated that 80 per cent of the population never receive dental service, at least service worthy of the name; and that this is a crying disgrace to our profession.

Just how the 80 per cent estimate was arrived at, we have never been credibly informed, but in any event we are assured of the fact that there are vast numbers of people who really need dental service and who are not receiving it. Some of this is unavoidable, for the very patent reason that there are certain individuals who are too far below the social or cultural scale to accept

dental service even if it were offered to them free of cost. But there is another class, and they are quite numerous, who present a real problem of genuine philanthropy. These are the people who need dental service, and who desire and deserve it, but who have not the means of securing it in the ordinary way.

As the education of the public on the need of oral hygiene has spread, it has brought an increasing number to this class, and the challenge is more and more insistently presented to the profession and to society to see that these people are cared for. In many cases, it is merely a temporary handicap that condemns them to deprivation in the matter of caring for their physical needs, but, temporary or permanent, there is the manifest obligation that they shall receive service.

The other horn of the dilemma is found in the fact that there are numerous dental offices in the land where too many idle hours confront the practitioner. Idleness of this sort—of any sort, in fact—is demoralizing in the extreme, and tends to discontent and distrust. Nothing in all human experience leads so inevitably to unhappiness and even to melancholy as idleness.

Why not dovetail the two conditions and bring about at least a partial solution of the present incongruity? Why not invite, through the proper auspices, large numbers of these needy citizens of our land into the private dental offices and care for them without charge? Why not occupy the precious time that otherwise is worse than wasted and devote it to the alleviation of some of the suffering and disability? This is no new idea. It has been advocated at various times by various members of the profession, and it has been put in practice by certain of them, and always to good advantage. Why has the idea not been more generally adopted? We do not know, but we suspect that one reason may be that the plan is not quite spectacular enough, and yet we are prone to believe that the real reason is that the masses of the profession have not quite sensed the great opportunity that is theirs through this medium.

If every member of the American Dental Association would volunteer to devote even two hours a week to the care of needy

children in their private offices, what a wealth of benefit might be gained! It would go a long way toward solving the problem of immediate stress, and it would make a profound impression on the public. No longer could it be intimated that we were remiss in our duty to society at large, or that we lacked in philanthropic acumen. The people would soon look up to us as a body of men and women worthy the respect of everyone, and we would soon assume an exalted status in the eyes of the world.

But possibly the greatest benefit of all would be to the profession itself. No thrill is ever quite so great as that to be gained by dispensing some loving service to the poor and needy. To take a little child suffering from dental disease or disability, and to relieve that child and change the tears to smiles is to catch a glimpse of what is meant by sanctified service, and no dentist can do this without being broadened and bettered thereby.

We commend this idea to the consideration of the entire profession. The individual sacrifice would be almost negligible, but the sum total of results would be beyond compare. Bound up in every worthy sentient human being, there is the inevitable urge to do something for the improvement of the race. Here is an opportunity for our profession—the question is, will they embrace it? If they do not, we shall continue to face the charge that we as a profession are remiss in our duty; if they do, we shall see such an awakening as we have seldom witnessed, and we shall at once wipe out the stigma of commercialism that threatens to engulf us in ever-increasing waves. Let us aim for more concrete philanthropy and less platitudinous theorizing; for the substance itself instead of the shadow.

THE ART OF THINKING

There are few of our attributes that are more neglected or abused than the art of thinking. In every relation of life, we constantly fall short of our possibilities when it comes to the exercise of our thinking powers. We too frequently think ineffectively or,

worse, we think wrongly. Negative thinking is really no thinking at all, and vicious thinking—of which we have too much in these latter days—is disastrous.

To properly control one's thoughts is to go far toward winning a kingdom—the kingdom of one's own achievement. To think constructively is to build mentality, and the mental equipment of the individual is the greatest asset that we possess. We cannot always control our thoughts to the best advantage, but we can do better than most of us do. Too often we permit our thoughts to fly off at a tangent and think small and unworthy things. Above all, we think inconsequential things, and the terrible waste of doing this is almost the worst sin that we commit.

Think straight through into the fundamentals of equity and justice, and we shall not go far astray in our actions, because our actions are largely governed by our thinking. To this extent, at least, we can control our thoughts.

JULES JOHN SARRAZIN, D.D.S.

(1865-1931)

Jules John Sarrazin died Sept. 14, 1931, at his home in New Orleans, La., of coronary embolus. He had been in poor health for about five years.

Dr. Sarrazin was born in the city in which he died, Oct. 15, 1865, the son of Jules Pierre Sarrazin and Marcelite Krebs Sarrazin. He received his early education in the Jesuits College, Tulane University, from which he graduated in 1883. He served his dental apprenticeship in the laboratory of the late C. Edmund Kells, Sr., and was graduated from the Baltimore College of Dentistry in 1887. In the same year, he entered on the practice of his profession in New Orleans.

He was a member of the American Dental Association, an ex-president of the Louisiana State Dental Society and of the New Orleans Stomatological Society, a member of the Orleans Parish Dental Society and of the First and the Second District Dental Societies of New York and of Louisiana, ex-president of the American Academy of Periodontology, a Fellow of the American Society of Stomatologists, a former member of the Research Committee of the American Dental Association, and formerly dean of the New Orleans College of Dentistry and of Loyola University School of Dentistry. He had recently been made a member of the honorary fraternity of Omicron Kappa Upsilon.

Dr. Sarrazin was married, April 24, 1920, to Dr. Jane Howard Sarrazin, who survives him, together with two sisters.

A man of high ideals and a born fighter for them, Dr. Sarrazin was persistent in his struggles for the right. He was a dynamo of mental energy, much of which was expended for his profession. He had achieved signal success in his specialty of periodontia.

CHARLES SHEPARD TULLER

FRANK T. BREENE, D.D.S., M.D.

As we go to press, word is received of the death of Frank T. Breene of Iowa City. A more extended notice will appear in the December issue.

DENTAL RELIEF

The 1931 Seals will soon be sent to you. Their purpose is well known to all of the members of the American Dental Association.

Were you ever hungry, with no money in your pocket, with no hope of getting any, hungry and sick and tired—oh, so tired and weary?

There are dentists just like that. They have tried hard, but fate seems to have stacked the cards against them. They have struggled along until now.

These lean times have meant some discomfort, some annoyance and some worry to most of us. To them, they have meant the end of all hope. Either we must help or they go to the poorhouse.

Do not limit your check this year to one dollar. Make it for five or ten dollars; make it large enough to be of real help if you can; but send the one dollar anyway.

The demands on the Fund have been heavy for the past year and they will be heavy for some time to come. There is nowhere you can place that money where it will do more good.

Remember, every cent goes to the Fund; there is no overhead, no salaries. It all helps feed and clothe those who are down and out.

The Dental Relief Committee,

OLIN KIRKLAND,
W. T. CHAMBERS,
EDWARD LINK,
FRED R. ADAMS, *Secretary*,
R. OTTOLENGUI, *Chairman*.

COUNCIL ON DENTAL THERAPEUTICS

ANNUAL REPORT OF THE COUNCIL ON DENTAL THERAPEUTICS

Following is the annual report of the Council on Dental Therapeutics to the Board of Trustees and the House of Delegates, modified by minor changes. It is presented to the readers of THE JOURNAL by arrangement with the Editor. Constructive comments concerning the work of the Council will be welcomed.

SAMUEL M. GORDON, *Secretary.*

The Council on Dental Therapeutics was organized in January, 1930, as an outgrowth of the A. D. A. Bureau of Chemistry. A general outline of a proposed council on dental therapeutics for the American Dental Association was presented to the House of Delegates at the Minneapolis meeting of the Association.[1] The plans for the proposed Council took form from the early experience of the A. D. A. Bureau of Chemistry and in anticipation of the program arising from that work.

Following the invitation of the Board of Trustees, the members now constituting the Council met in Chicago in January, 1930, for organization. The roster of the Council, which has been published elsewhere, contains the names of scientists in the basic subjects related to dentistry and of dentists in various branches of their profession. The sciences represented in the Council are chemistry, pharmacology, physiology, bacteriology, pathology and the clinical branches of dentistry. Such membership insures all-round discussion and opinion on the various matters dealt with by the Council.

One of the first actions of the Council, following organization, was the adoption of a set of ten rules to serve as a basis for the consideration of products of a dental nature submitted to it, or examined on its own account by the Council. In the consideration of dental products for admission to the list "Accepted Dental Remedies," the Council is governed strictly by these rules.

The rules of the Council are an adaptation of the rules of the Council on Pharmacy and Chemistry of the American Medical Association. The rules and the statement of scope were published in THE JOURNAL. Following publication of the rules in THE JOURNAL, as mentioned above, they, with explanatory comments thereon, were reprinted in pamphlet form. These are sent without charge, as are reprints of the various reports of the Council.

From the very outset, the members of the Council appreciated that the broad objects of the Council; namely, protecting the dental profession and the public

1. Tr. Seventieth Annual Session A. D. A., 1928, p. 277.

against fraud or imposition, undesirable secrecy and objectionable advertising in connection with the marketing of proprietary dental remedies and the rationalization of dental therapeutics, could be realized only through a campaign of published reports. Hence, the Council has constantly endeavored to publish reports containing its decisions.

The Council lost no time in entering on its work. Since March, 1930, reports holding the products listed below not acceptable for Accepted Dental Remedies have appeared in THE JOURNAL: Perdentin, V. A. D. Dentifrice, Phennol, Pyros, Pearlo Tooth Powder, New Mix Dental Cream, Nasene, Kemozone, Forhan's Dentifrice and the Sherman L. Davis products.

Subsequently to the report of the Council holding Pyros not acceptable, the Government seized packages of the product and brought action against the company. The courts held with the Government that the product was marketed in a false and fraudulent manner.

The report of the Sherman L. Davis products was of especial interest because of the platform activities of Dr. Davis. It will be recalled that the Council held that these products, which, on the whole, were not shown to be other than mixtures of well-known drugs, were being sold before the necessary carefully controlled evidence had been made available to warrant the broad claims made by their exploiters.

It is almost a year since the report of the Council appeared, yet the evidence which the Council, speaking for dentists, requested has not yet been made available. In a sense, the exploitation of these products illustrates some of the problems which the Council frequently encounters; namely, those instances in which many dentists are led to give testimonials in the guise of clinical reports for products after only a most cursory examination. Were the matter to end there, there might be no harm done, but the exploiters who obtain such testimonials use them as "evidence" to persuade other dentists to purchase or recommend the product. It may be stated with some measure of confidence that the report of the Council did much to bring some sanity to the large problem of diet and dentition. It will not be denied by many that there is an intimate relationship between the two. Unwarranted generalities or the sale of products exploited with claims which are unwarranted by the available evidence will do much to retard the rational application of this sort of therapy. The progress is slow, coming from the laboratory and clinic and not from exploiters of drugs of unproven value and from platform lecturers. The Council is ready to lend encouragement to work which is done upon a firm foundation of careful experimentation and recording.

THE WORK OF THE COUNCIL

Below is presented in statistical form the products which are considered by the Council. A word of explanation is in order. An attempt to estimate the effect of the Council's work in a statistical manner would be entirely erroneous, for it would give no adequate idea of the amount of work being exacted of the members of the Council, or of its apparent effect on the profession as expressed in individual communications, resolutions, etc. Announcements of acceptance of a number of products have appeared in THE JOURNAL in the course of the year.

The accompanying tabulation serves to give an idea of the magnitude of the Council's work (as of May 22, 1931.)

Products considered	125
Acceptance announced	27
Acceptance recommended but still under consideration	29
Acceptance not recommended but still under consideration	7
Not acceptable but publication withheld for time being	27
Products on which the Council is awaiting more evidence from proprietor	11
Awaiting reports of referee	11
Acceptable but announcement delayed for time being	3
Not acceptable and published	10

This list does not include more than 100 official and nonofficial preparations being investigated by the Council in the preparation of the book "Accepted Dental Remedies." Each product may be the subject of one or more reports and of much correspondence between the Council and the proprietor. Many of the preparations in the accompanying tabulation which are unacceptable at the moment have not been the subject of published reports because of the custom already established by the Council of sending a report containing the Council's views to the manufacturer in order to give him an opportunity to change his views or revise the product or advertising according to the Council's recommendations. Incidentally, it may be of interest that several manufacturers of tooth powders have removed potentially harmful substances from their products on the suggestion of the Council. Other products may be made acceptable provided certain conditions are complied with; etc. Then there are products the composition of which and the exploitation of which are so rank as to be outrightly declared not acceptable. In any event, a report of the Council, either condemnatory or commendatory, is not published until the manufacturer has seen the proposed report. Furthermore, the Council has gone out of its way to send reports to certain manufacturers who did not submit their products to the Council and which were examined on the initiative of the Council, following requests from members of the profession for information concerning them. By its published procedure, the Council is not bound to submit reports to manufacturers who do not cooperate with the Council.

HOW THE COUNCIL WORKS

The procedure of the Council has been published elsewhere.[2] It would not be repetition to put before this body an outline as to how the Council works, for, in the last analysis, the Council is but the servant of the profession in its field of the public health.

The Council is divided into a number of committees, such as the Committee on Rules and Procedure; Committee on Pharmacology and Therapeutics; Committee on Bacteriology, Pharmacy and Chemistry and Committee on Lay Advertising. Of necessity, the work of the Council is carried on entirely by correspondence. Hence, an elaborate indexing and filing system is maintained by the secretary at the headquarters building, communication between the members being through a bulletin prepared by the secretary at regular intervals and sent to each member of the

2. Gordon, S. M.: Work of A. D. A. Bureau of Chemistry and Council on Dental Therapeutics, J. A. D. A., 18:652 (April) 1931.

Council. Each bulletin is accompanied by a summary sheet and a vote sheet, by means of which votes and discussions on the material presented in each bulletin are taken. Thus, the expressions of the members will be their own studied opinions and are not influenced by personal considerations such as may arise in meetings.

When a product or an item of business comes to the Council for consideration, it is assigned to an appropriate committee, a member of which is asked to act as referee, and all pertinent data available are sent to him. The referee's name is not disclosed. In due time, the report of the referee appears in the bulletin, following which discussion is asked, and a vote taken after the appearance of the discussion. In general, the material in the bulletin is arranged in orderly fashion, such as recommendations, reports, supplemental reports, discussion, motions, correspondence and votes. By means of the bulletin, fulfilment of the Council's announced objective—a continuously functioning body—is made possible.

THE DENTIFRICE PROBLEM

There is probably a no more pressing, and intrinsically no less important, problem than that of the dentifrice. Advertising conditions of the dentifrice before and after the advent of the Council have been noted elsewhere. In order to bring some sanity into the advertising which was outstandingly ridiculous, the Council took a very liberal position. In view of the inability to verify by adequate evidence most of the claims that have been made at one time or another for dentifrices, the Council agreed to accept dentifrices for its official list provided claims are strictly limited to their efficacy as an aid in the hygiene of the oral cavity and particularly to their mechanical cleansing properties; no therapeutic, chemical or bacteriologic claims are made or inferred in their exploitation; therapeutically suggestive names are not used as a brand name; the brand name is not indicative of a component which does not possess proven therapeutic properties or other inferred properties implied in the name, and there is no conflict with the rules of the Council. The provisions in reference to proprietary names will not be retroactive (April, 1930).

As the protection of the public through the medium of the dental profession is one of the primary concerns of the Council, it was felt that a forward step was taken if it could promulgate a reasonable definition for the functions of dentifrices. According to the Council's definition, a dentifrice is a liquid, powder or paste which aids in the cleaning of surfaces of the teeth by means of the toothbrush. General acceptance of this reasonable definition and adherence of advertising copy to such a definition would remove from the publishing field one of the most obnoxious types of advertising which have appeared in many years, and, at the same time, remove the confusion from the minds of readers of these publications. At the same time, it would give to the dentist an answer to the ubiquitous question, "Doctor, what dentifrice shall I use?" It removes from him the responsibility of attempting to support claims for which there is no available evidence.

The desire of the Council to recognize "good will" which may have been built up for the names of dentifrices on the market prior to the formation of the Council was given tangible form by the statement of provisions regarding dentifrices: "The provisions in reference to proprietary names will not be retroactive," as of April, 1930. While, in general, dentifrices are useful cosmetic agents and have a legiti-

mate, though extremely limited, use, the liberal provisions of the Council for the acceptance of these articles was provided for, on the assurance of the manufacturer that the advertising would be modified and had reasonable claims.

There are more than 100 different trade names for the three or four general types of dentifrices on the market. Up to the present time, only eight of these trademarked products have been recognized as acceptable to the Council. Most of them are now being considered. While the provisions of the Council for dentifrices are directed mainly toward the advertising of these products, it of necessity carefully considers the composition of these articles, as to both possible harmfulness and the validity of claims. The Council cannot accept dentifrices intended for daily use by the public if an examination of composition reveals the presence of a constituent which may be considered potentially harmful. On this account, admission was definitely refused to several dentifrices which contained substances of a strongly abrasive nature, such as pumice, silica, kieselguhr or other substances of potentially abrasive nature. Nonacceptability was maintained, despite the circumstance that several firms revised their advertising.

The advertising of some of the dentifrices now before the Council for consideration needs radical revision before they can be declared acceptable. While the advertising of other firms has been revised sufficiently that they conform to the provisions of the Council, because of the manifold difficulties involved in such work announcement of acceptance must be delayed until the Council is assured that the promises of revision will be carried out.

In reference to dentifrices, the first year of the Council has been one of feeling its way. It has, accordingly, taken a liberal though conservative attitude toward the acceptance of this class of products. It has taken the position of accepting too few rather than too many products, for if products are accepted indiscriminately with inadequate assurances as to the type of future advertising, the effects of the work of the Council would not be of a permanent nature. Comparison of marketing conditions for dentifrices today and a few years ago reveals a remarkable difference, due in some measure to the reports of this Council and to the cooperation which it has given to semipublic bodies. The National Better Business Bureau, which stands for fairness in advertising, has called on the Council for assistance in verifying the claims made for dentifrices. The Council has also furnished information to other semipublic organizations for transmission to the public. Many of these organizations write to the Council for unbiased advice in this field.

THE SEAL OF THE COUNCIL

The Council, following the lead of other investigative bodies of a similar nature, has adopted an identifying seal which may be used in connection with the advertising of acceptable products. A set of rules rigorously defining the manner in which the seal may be used in advertising was published in THE JOURNAL, April, 1931, p. 748. The acceptance of dentifrices and permission for use of the seal are matters which demand constant watchfulness. The use of the seal in advertising, such as in street cars. As the Council is working for the profession, it hopes a manufacturer of a product which is declared acceptable makes an unwarranted use of the seal, his attention is immediately called to such action and the matter

reported to the proper referee of the Council for appropriate report. Despite the rules for the use of the seal and the statements which may be made in connection with acceptable products, the Council cannot hope not to overlook certain types of advertising, such as in street cars. As the Council is working for the profession, it hopes that all members of the Association will report any cases of unwarranted use of the seal or advertising of accepted products, whereupon proper action will be taken by the Council to safeguard the interests of the profession without injuring the advertising program of acceptable products.

The *New York Journal of Dentistry,* of which Martin Dewey, President-Elect of the Association, is president, has undertaken to acquaint dentists with the significance of the seal. The project was submitted and given the approval of the Council on the basis of written statements made to it by Martin Dewey and John T. Hanks, secretary of that journal.

THE LARGER PROGRAM OF THE COUNCIL

An erroneous idea seems to have entered the minds of advertisers and even many dentists that the work of the Council centers solely around the question of dentifrices. The dentifrice question in the long run is more pressing than important for reasons already pointed out.

The work of the Council, like the broad aims of the dental profession, is but one part of the public health service in which dentistry plays so important a part. The main work of the Council is concerned with making available to the profession a list of acceptable medicinal agents, with sound information and honest advertising concerning their use. In carrying out these purposes, it attempts to evaluate evidence in the light of the rules governing the Council. The Council attempts, wherever possible, to secure what may be considered adequate scientific evidence. Unfortunately, not only for the progress of the Council's work, but also for advances in dental drug therapeutics, there is a dearth of fundamental scientific evidence concerning the pharmacodynamic and clinical action of many of the medicinal agents used in dentistry. Furthermore, many dentists are too prone to give testimonials in the guise of clinical reports for many products which sometimes turn out worthless, or, at best, nothing more than official products disguised under noninforming trade names. Unfortunately, again, many dentists confuse the issue between an individual product and the pharmaceutic house putting it out. It must be considered that houses of otherwise excellent reputation sometimes put out preparations which are hardly in accord with many of their other acceptable products. Again, one of the oldest pharmaceutic houses, from whom better things might have been expected, actually took to advertising of blatant patent medicine character for their dentifrice. In the investigation of products, the Council considers solely and wholly the evidence for a product at the time of investigation except, of course, when it is manifest to the Council that the general activities of a house are not in the interests of the dental profession and the public.

Unhappily for the dental profession, and in turn for the public, many manufacturers of good repute and having good products of a proprietary nature have too long stayed away from the dental field. In a constructive sense, it is hoped that the work of the Council will be conducive to the marketing of products by houses

that have a sense of responsibility, not only to their stockholders, but also to those who are asked to use their products.

It is apparent that the work of the Council on Pharmacy and Chemistry of the American Medical Association, which twenty-five years ago faced situations similar to those now presented to this Council, has been instrumental in large measure in elevating the status of pharmaceutic chemistry in this country.

This desideratum is slowly but surely being brought about in the dental field, as may be gaged by the informal agreement of representatives of one of the larger pharmaceutic houses to revise its dental products in such a way as to bring them in conformity with the rules of the Council in regard to composition, claims, etc. One large house of favorable reputation took occasion in the early part of this year to submit many products of dental interest to the Council. Most of these have been examined and announced as acceptable.

The Council is surveying many products possibly of dental interest which have not been submitted to it by the manufacturers. These are being considered as part of the preparation of the book "Accepted Dental Remedies," which entails not only an assay of proprietary products on the market, but also publication of the whole list of drugs useful in dental therapeutics by the general practitioner or by the dental specialist. Several chapters of this proposed book have passed through the Council and are ready for publication, while others are in the process of preparation or are under consideration. The Council is attempting to maintain a conservative attitude in the statements concerning useful drugs of dental interest. The members entrusted with the preparation of the chapters for "Accepted Dental Remedies" are counseled by the action of the Council that the book is not to be made top-heavy with useless preparations or those essentially similar to official products. At the present rate of progress, it is conceivable that the manuscript for the book will be ready for the printer before another meeting of the House of Delegates. At that time, the Council would request that the publication of this book under the auspices of the Association be undertaken by making suitable financial arrangements.

An important part of the Council's work is the answering of inquiries sent to it by members of the dental profession, the public and different semipublic or public bodies. Whenever the information is available in the files of the Council, an early reply is made. When such information is not available, it is referred to the proper specialist on the Council with the request that the basis of a reply be furnished. In the course of the year, many such inquiries have come to the Council and the correspondence from this source is increasing at a rapid rate.

In the course of the year many inquiries were made for products which had not been considered by the Council. This necessitated an examination by the Council to determine the status of the product even though such examination had not been requested by the manufacturer. In this way, reports have been prepared, and have been sent to the manufacturer for consideration. If the manufacturer shows a willingness to meet the suggestions of the Council, action is postponed for a reasonable length of time.

EDUCATIONAL ARTICLES ON PHARMACOLOGY AND THERAPEUTICS

Despite the more or less regular appearance of reports of the Council, both of a commendatory and of a condemnatory nature, the objects of the Council can be

greatly aided by coupling with its reports a progressive educational program. To realize, at least in part, this purpose, the members of the Council and others invited by the Council undertook the preparation of a series of articles on pharmacologic and therapeutic subjects of broad interest to the profession. To date, several of these articles have appeared. Other articles have been prepared or are in the course of preparation and will be issued as soon as conditions warrant.

It would be of distinct help if a small sum of money could be obtained in compensation of some qualified person who would conduct a column in THE JOURNAL on practical pharmacology and therapeutics with emphasis on official drugs and preparations thereof. It is not too much to expect that the readers of such a column, if properly carried out, would appreciate not only the usefulness but also the limitations of the use of drugs. It is axiomatic that sound therapy requires a knowledge not only of when to use a drug or a method of treatment but also how and why to use one.

THERAPEUTIC INVESTIGATION

In the consideration of dental articles, the Council attempts to give, as far as possible, an unbiased opinion based on the evidence available. The Council attacks its problems on the general thesis that the intelligent practitioner attempts to find the cause of a disease and remove it as far as possible. If the direct etiology of a condition is not well established, the Council must of necessity rely on clinical evidence, which, in order to be acceptable, must offer *objective* data with such citation of sources as will enable the Council to confirm the facts and establish the scientific value of the conclusions drawn. The evidence that the Council requires may, of course, come from different sources. It is to be expected, naturally, that the burden of proof for the claims made regarding dental products with protected names rests entirely on the proprietor. When this information is available from such sources, it is considered in the light of what may be looked on as adequate information on the subject. Where it is not available, the Council attempts to obtain the best available evidence by consultation with clinicians. Unfortunately, much of the evidence accredited to dentists and coming to the Council from manufacturers is of an uncritical nature. In a sense, this is a reflection of the undiscriminating manner in which evidence in drug therapeutics is obtained. When the profession becomes convinced of the inadequacy of these glowing testimonials, they will then not be so easily misled by them, broadcast as they are for the purpose of increasing sales, by advertisers or by ill-informed persons. Hence, if the Council is to achieve its stated aims, it must attempt to replace, wherever possible, opinion by fact. The Council recognizes that this is by no means a problem readily solved, but that its possible solution may be forecast by the advances in dental education of the last few years. The Council attempts to encourage the obtaining of factual data in place of opinionated expression. To this end, one member of the Council is carrying on, without remuneration from the Association, two investigative projects in connection with products submitted to the Council. The Council, after due arrangement with the Budget and Finance Committee of the Board of Trustees, has extended from its own limited funds two grants-in-aid of $200 each for the encouragement of fundamental investigations in the field of dental therapeutics.

These are an investigation of "The Various Therapeutic Agents Employed in the Treatment of Hypersensitive Dentin," by Hermann Prinz, of the University of Pennsylvania Dental School, and a study of "The Prolongation of Local Anesthetic Action," by Prof. Chauncey D. Leake, of the University of California, Department of Pharmacology.

There are a number of investigative problems relating to dental therapeutics which could profitably be pursued. Of direct practical importance, the potassium chlorate question may be mentioned. Potassium chlorate, introduced into dentistry some years ago as a remedy for stomatitis, is a component of several tooth pastes and powders on the market. Perennial airing of opinions concernings its toxic properties have been raised from time to time, yet an investigation of the literature reveals an almost total lack of reliably obtained factual data concerning the effects of potassium chlorate when used in a dentifricial manner. A small grant of money advanced to a competent worker who might be induced to investigate the problem under the auspices of the Council would, it is conceivable, settle once and for all the use of such compounds in a tooth paste.

The Council has been fortunate in securing the assistance of the members of a component group of the Association to carry out an investigation of the cleansing properties of a tooth paste being considered by the Council. The results are available for publication, but publication is being withheld because of the fact that this product is being advertised in THE JOURNAL. [Ed. Note: The contract for the advertising of this product was made before the Council considered the product.] Numberless other investigations of the validity of claims for dental products have been suggested. The Council, therefore, believes its work would be materially assisted by the use of a suitable fund for therapeutic investigation which would enable it to assist or promote investigation of problems within its scope, or to invite competently trained investigators in the fields related to dentistry to undertake such problems. The problems which might come within this classification would in no way conflict with other research programs of the Association, the chief purpose being to obtain factual data on the medicinal products of dentistry. The availability of such a fund, it is believed, would help not only to solve the therapeutic problems of dentistry, in a measure, but also to modernize the teaching of pharmacology and therapeutics in dental schools and thus establish a firm foundation on which future progress in this work should rest. With this in mind, the Council has requested for its next budget an appropriation to encourage qualified investigators to carry on specific investigative problems for the Council. It is not immodest for the Council to state that its membership contains workers who have done research work accorded a high measure of recognition; which would insure the proper placement of grants.

THE COUNCIL AND DENTAL SCHOOLS

From the very outset, the Council has recognized the close interrelationship of its work and instruction in dental schools. Hence, a committee on the cooperation of the Council and dental schools has been arranged. This committee is undertaking a survey of instruction in these subjects in dental schools, as it may relate to its work. This committee has, in some measure, been responsible for a renewed and healthy interest in the subject among teachers of dental therapeutics.

The indications are that the work of the Council has appealed not only to the general practitioner, but also to teachers of materia medica and therapeutics. Several teachers of this subject are using the published reports of the Council as collateral material in the teaching of these courses. The interest of teachers was further evidenced at the meeting of the Dental Faculties Association, March, 1930, at which a whole program was devoted to the subject of materia medica and the subsequent organization within that group of a section on pharmacology and therapeutics.

THE FUTURE

Subsequent to the presentation of the report of the Council on Dental Therapeutics to the House of Delegates at the Seventy-Second Annual Session held in Denver, the confidence of the House in the work of the Council was expressed in the following resolution, presented by Dr. McDowell of California:

> *Resolved,* that the House of Delegates of the American Dental Association go on record as endorsing the accomplishments of, and the future program of its Council on Dental Therapeutics and to express its appreciation of the splendid cooperation of the American Dental Association in safeguarding the interests of the public and the profession.

This was carried.[3]

This expression of confidence on the part of the House of Delegates for past activities and future activities of the Council, coupled with the resolutions of the Board of Trustees adopted at the request of the Council,[4] caused the Council to feel that work of this kind was appreciated by the profession. This expressed appreciation stimulated the members of the Council to take from their already overburdened time precious minutes to participate in the work of the American Dental Association. This Council proceeded with its well-arranged and preconceived program. From such expressions as those already alluded to and from communications which had been received at the office of the Council, opinions expressed in editorials and resolutions of appreciation taken by component societies, the Council felt that its work enjoyed the confidence of the profession.

What the future of the Council is to be rests clearly with the profession itself. If it has the support of the profession and its recognized officers, there is no doubt that the program will succeed. If the support is not whole-hearted, the Council might well drop its work now; for, in work of this sort, the profession cannot afford to compromise with the highest professional standards. The Council must be free to carry on the work in such manner as is best determined by the amount of evidence and correspondence in its files.

ADDRESSES BY MEMBERS OF THE COUNCIL

During the past year, several members of the Council have addressed dental gatherings on the work of the Council.

Harold S. Smith, chairman of the Council, and Prof. Paul J. Hanzlik, vice-chairman of the Council, took part in a symposium on therapeutics at the midwinter meeting of the Chicago Dental Society.

3. Footnote 1, p. 259.

4. Footnote 1, pp. 37, 107.

The secretary of the Council addressed, in the course of the year, the following dental organizations: South Bend Dental Society, Milwaukee County Society, the Odontographic Club of Chicago, the Chicago Dental Society, the Racine Dental Society, the Fifth District Dental Society of Michigan, the Illinois State Dental Society and the St. Louis Dental Society. In addition, the educational exhibit of the Council was shown at Detroit and San Francisco.

ACKNOWLEDGMENTS

As in the past, the Council has graciously received the assistance of members of the dental and allied professions. The South Bend (Ind.) Dental Society carried out an investigation on the claimed cleansing powers of a widely advertised tooth paste under the direction of Harold T. Dailey, former instructor in pharmacology and oral surgery at Northwestern University Dental School.

Charles W. Freeman, associate professor of oral surgery at Northwestern Dental School, assisted the Council in the consideration of certain products in the preparation of several chapters for the book "Accepted Dental Remedies." Prof. M. L. Tainter of Stanford University School of Medicine, and Prof. Russell W. Bunting of the University of Michigan Dental School, prepared, at the invitation of the Council, several articles in the series of articles on pharmacology and therapeutics.

The Council takes this official means of expressing its hearty appreciation to the members of the Association, to editors of component society dental bulletins and to others who, during the course of the year, have been good enough to express their commendatory thoughts on the work of the Council.

In conclusion, the Council desires to point out that unless it has the wholehearted and unswerving support of the dental profession, and is given unfettered authority for its work by the American Dental Association, it cannot hope to succeed in the work which it has undertaken, i.e., to protect the dental profession and the public against fraud or imposition, undesirable secrecy and objectionable advertising in connection with the marketing of proprietary dental articles.

BUREAU OF DENTAL HEALTH EDUCATION

THE CARE OF THE HOSPITAL STAFF

By JOSEPH ERDREICH,* D.M.D., New York City

THIS article is written in an endeavor to show administrative officials what the dental staff at the New York Post-Graduate Medical School and Hospital is doing as regards the dental examination and care of employes, nurses and patients.

The dental department makes a routine examination of every patient admitted to the wards of the medical service and immediately does all necessary dental work. The staff has yet to include the surgical service in the routine examination and care. However, all consultation requests for examination and care are promptly attended to. The staff hopes some day to have the surgical wards under its jurisdiction.

Many student nurses come under our care, but, unfortunately, only when they are troubled with a toothache. In almost every case, it has been found that the tooth involved was so far gone that it had to be extracted. Provision is made for oral surgery in cases of this sort, but, unfortunately, none whatsoever for prophylaxis and restorative work. Naturally, the student nurse earning no salary cannot afford to have dental work done by general practitioners. They are granted all the medical attention that they may require, but no provision is made even for an examination by the dental staff.

The same condition obtains among employes of the hospital. This will presently be explained. Only oral surgery is afforded them. Here again, we find a peculiar situation. All prospective employes are given a thorough medical examination before being granted employment. They are given complete medical attention after being employed, if they should become ill, but their dental condition is sadly neglected as far as preventive surgery is concerned. Considering the low wages some employes receive, and the low scale of living they are accustomed to, one does not wonder why they do not take care of their teeth.

After a case of Vincent's infection was found among the nurses, another among the interns and then a few scattered cases among the aides and secretaries employed in the hospital, suspicion was aroused as to the prevalence of Vincent's infection in the hospital, and the fear of its spreading throughout the staff made urgent measures necessary. Attention was directed to the dietary staff and pressure brought to bear on the situation. As a result, every dietary employe was given a thorough dental examination, the findings of which are presented in the accompanying tabulation.

*Dental Intern, New York Post-Graduate Medical School and Hospital.

We found fourteen cases of Vincent's in a dietary staff of seventy-two. There were seventeen cases of pyorrhea, and, in addition, there were twenty-six persons having gingivitis of varying degrees and serious enough to have the mouth charted as unclean. Five mouths were found to be clean and well kept, though needing prophylactic care, and ten of the staff had excellent mouths as far as the cleanliness of the teeth and the condition of the gums were concerned. Three of these then wore full dentures.

RESULTS OF EXAMINATIONS

Condition of Mouth	Cavities	Extractions Necessary	Teeth Missing	Fillings Present
	Men			
Excellent	4	16	1	19	1
Good	3	8	1	3	1
Fair	8	22	2	10	9
Pyorrhea	7	22	4	43	3
Vincent's	7	18	28	55	..
Total	29	86	36	130	14
	Women				
Excellent	6	8	..	10	7
Good	2	3	2	11	10
Fair	18	74	16	73	35
Pyorrhea	10	12	27	79	2
Vincent's	7	45	10	32	..
Total	43	142	55	205	54

The fourteen cases of Vincent's were given immediate attention and preference in the clinic. The patients were given leave of absence from work while under treatment, until the infection had been eliminated. The cases of pyorrhea were placed under treatment as well. Now provision is being made for the restorative work in an effort to eliminate the 228 cavities found. Incidentally, all dietary employes with residual roots and badly broken down teeth had to have them removed in order to retain their positions.

The dietary staff, we found, cooperated well, accepting the dictates of the examining dentist philosophically and unquestioningly. Two patients of the seventy-five asked if the work could be done by their own dentist.

This article evidences the necessity for the dental care of all those employed in and around institutions, in order to prevent findings similar to ours. Each prospective kitchen employe should be given a dental examination before employment. We are still striving to have each student nurse, on entering training, examined by our department and provisions made for her dental care. Similarly, we recommend the examination and care of the employes on all the staffs throughout the hospital.

The condition of the mouths was charted in the following manner:

Excellent: Gums in a healthy condition, and teeth free from stain and tartar.

Good: Gums in a healthy state, but teeth in need of a prophylaxis.

Fair: Gums showing gingivitis of varying degrees and teeth in need of scaling and prophylaxis.

Pyorrhea: Mouths in an unclean state, with pus present.

Vincent's infection: Mouths presenting symptoms of this disease.

THE BONN METHOD FOR THE DENTAL CARE OF SCHOOL CHILDREN

By FRIEDRICH NEUMANN,* M.D., Prague, Czechoslovakia

DURING my stay in the United States, I was fortunate enough to meet a great number of those men who are especially interested and active in oral hygiene work and school dentistry. These men have shown an extraordinary interest in the organization of the dental care of school children at Bonn, Germany, and I was asked to write a short paper on that subject for THE JOURNAL.

THE HISTORY OF THE "BONN SYSTEM"

In 1912, Dr. Kantorowicz, at that time assistant in the dental clinic of the University of Munich, was enabled to make an experiment to prove his theories about the best methods in school dentistry. He obtained sufficient money to equip a small clinic at Ruhpolding, a town in Bavaria having among its population only a few hundred children. He was accompanied there by some of his associates, and together they did the most necessary dental work for all the children of this town. They did not treat deciduous teeth when there was no permanent one endangered by the contact with the decayed surface, but they were extremely careful to detect even the smallest area of decay in the permanent teeth. They did not cut out every fissure, but they did fill them if the explorer seemed to indicate a small area of decay, and also when decay was not quite certain. They tried to fill all the small cavities and they kept watch over these patients to determine whether decay was effectively checked. Their observations convinced them that there was a very small increase of caries in the mouths of these children. The war interrupted the work at Ruhpolding.

After the war, Kantorowicz was appointed director of the dental school of the University of Bonn, a city of 100,000 inhabitants, situated on the Rhine, near Cologne. There was a school dental clinic in connection with this dental school, and here Kantorowicz immediately tried to apply the method of dental care with which he had experimented at Ruhpolding. Realizing that because of the large number of children involved, there was no possibility of treating all cases at once, he attempted to obtain the same results by a system of successive years of treatment.

HOW CHILDREN ARE TREATED AT BONN

Every child, on entering school, at the age of 6 years, is examined by the school dentist. The dentist visits the children in the classroom, taking a woman assistant with him. (In Bonn, nuns do this work.) These assistants bring with them a supply of fifty mirrors and fifty explorers, as well as necessary sterilization equipment. At this time, the dentist explains to the children why he has come to see them, but on later visits he does

*Assistant, State Dental Institute.

not do much talking. He gives the teacher the children's charts, which are to be described later on, and takes his seat in front of the children. The children pass by him in single file after obtaining their charts from the teacher, and the dentist makes a rapid examination of the teeth, using only a mirror and an explorer. After necessary recordings have been made, the assistant takes the children's charts and puts them into two different piles, one pile for the children showing no decay necessitating treatment, and the other for the children showing decay, including all those cases in which there is some doubt. This is done be-

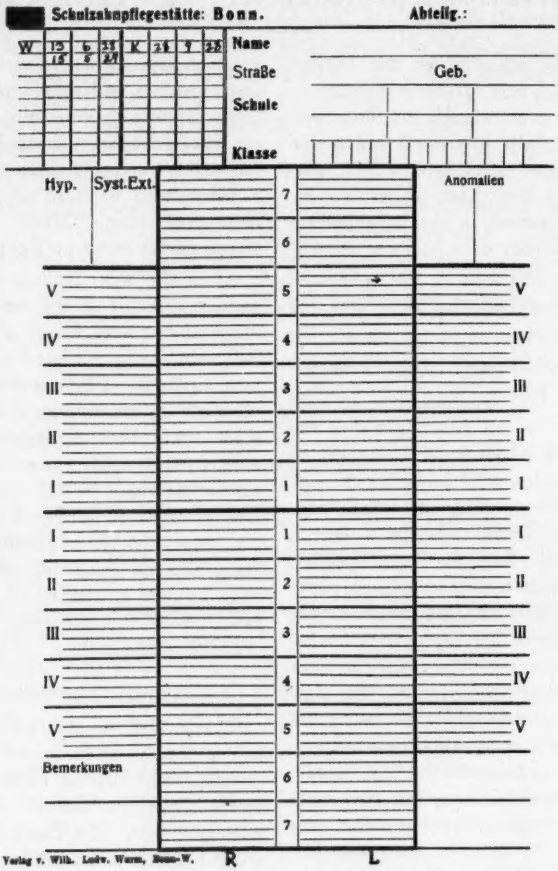

Fig. 1.—Front of record card. "W" means that the child resisted examination or treatment. "13-6-28" means the thirteenth day of the sixth month of 1928. "K" means that the child was ill at the time of examination and did not appear for treatment at a later date.

cause exact examination is not made at this time, but all children whose charts have been positively or doubtfully marked as to the presence of decay are ordered to come to the clinic for a careful examination and for treatment if necessary. Thus, the initial examination go to the clinic whenever they please, appointments being arranged for a group of ten, and the teacher requested to send those who are indicated. These appointments are arranged for in the hours during which school is in session. At the time of examination, each child receives

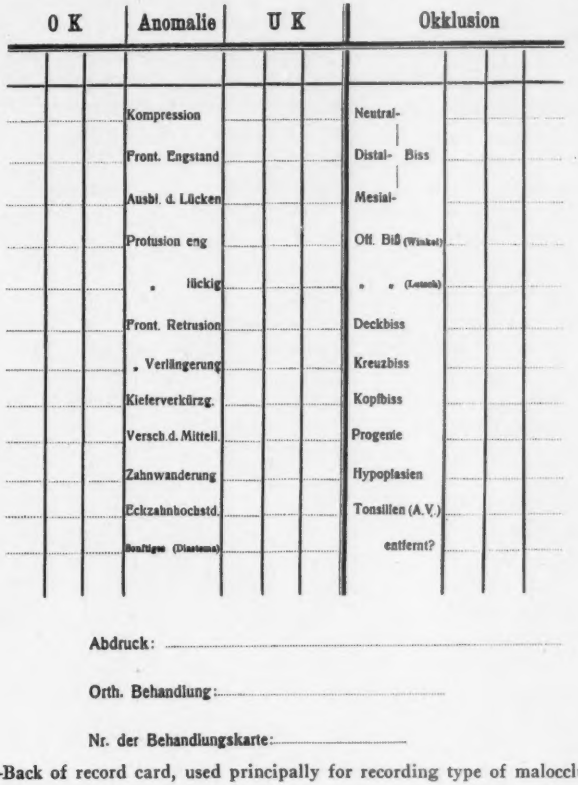

Fig. 2.—Back of record card, used principally for recording type of malocclusion.

of fifty children does not take more than ten or fifteen minutes. It might be added that all those children who are not in school on the day of examination and whose charts are left in the hands of the teacher are ordered to the clinic for examination. Children are not allowed to a certificate as to the cleanliness of his teeth. Those showing well cleaned teeth receive a white certificate, the others, a green certificate calling the parent's attention to the state of tooth cleanliness. After the certificates have been signed by the parents, the children are told to

bring them back to the teacher. On the back of the certificates, the parents are told that, through arrangements made by the city of Bonn, school children may purchase in any drug store a toothbrush and a box of tooth powder for 50 Pfennig (12½ cents), and that this box will be refilled for 5 Pfennig (1½ cents).

Prizes are given for well cleaned teeth. At first these prizes were distributed among the children, but when the number of children entitled to such prizes increased, the prizes were awarded the classes showing the highest percentage of well-cleaned teeth. In that way, the negligent pupils were influenced by their classmates to give more careful attention to brushing their teeth.

Every child whose parents have given their consent (which the teacher tries to obtain as soon as the child enters school) is treated in the school dental clinics free of charge. The clinics are very small, containing nothing but the most necessary equipment, but they are arranged in such a way as to make rapid work possible. For example, there are two wash basins so that the dentist and the nurse can wash their hands at the same time. The instruments in use are very simple and only a few kinds are used, but a large number of each kind are at hand to assure rapid work. No bur is used a second time without being resharpened.

The dentist records all dental work on the child's chart immediately after completion of the service. These charts are very simple in design. (Figs. 1 and 2.) A space is provided for each tooth. The upper left corner of the chart is used to record the date of the dental examination, if the child did not need any treatment, or the date on which all necessary work has been completed. The letter W (*Widerspenstig,* i.e., offering resistance) when entered in this space, indicates that the child resisted examination or treatment, and the letter K (*Krank,* i.e., ill) that the child was ill at the time of the examination and did not appear for treatment at a later time. During each new year, the dentist uses an ink of a different color in his fountain pen so that all dental work done within a certain year may be noted immediately. It requires but a minimum of time for the dentist to thus record the work done, and, during this interval, the nurse takes care of the instruments and seats another child in the chair. In this way, the dentist does not lose any time.

By doing nothing but children's dentistry, the dentist develops extraordinary skill in handling that type of work. Consequently, it is desirable that he continue in this position. He is encouraged to remain by a rising scale of salary, nomination as a municipal official (who cannot be dismissed in Germany except in case of a grave offense), and assurance of a pension after a certain number of years of service. In order to secure his whole attention and energy for his work as a school dentist, he is not allowed to do other work in his spare time.

The results of this method of dental care are excellent. There are few children showing dental decay in the towns that have carried out this program. Of course, it is not possible, under the present conditions in Germany, and probably not anywhere in the world, to have all the dental work for all the children done at once. So, the dentists first treat only the children of the first grade. During the following year, these children are reexamined and treated again, if necessary, and the children newly entering the first grade are treated too. This plan

is carried out year after year, the initial first grade and each succeeding class being annually reexamined and cared for until they leave school. Thus, in a period of years, the teeth of the whole school are conditioned at a minimum of expense, because children regularly examined and treated from the age of 6 do not need much dental attention. An average of about 2 Reichsmark (fifty cents) a year is spent for each child.

Bonn, after using this system of dental care for twelve years, has about 92 per cent of its pupils leaving school at 14 years of age without any dental decay. More than 300,000 pupils in Germany, Austria, and Czechoslovakia have been provided with this type of dental care, and 87.78 per cent of them do not show any decay of the permanent teeth.

Undoubtedly, this method of dental care for school children is the most efficient one in Central Europe, and the results are most gratifying. I should not like to appear to be recommending it for the United States, as conditions are different in different countries. The dental profession in the states is doing admirable work for the children, as I have personally observed, but I am deeply interested in learning how other countries are handling this problem.

TEETH AS THEY AFFECT PERSONALITY*

By WILLIAM H. GILPATRIC, D.D.S., Boston, Mass.

MY subject, "Teeth as They Affect Personality," shall come from three points of view: (1) prevention of disease; (2) what modern dentistry should do for you, and (3) the particular points about good teeth and health in the mouth as related to personality.

To go back to 1872: Oliver Wendell Holmes, the famous author and poet, who was also a professor at the Harvard Medical School, had the following remarks to make about dentistry as it affects personality:

> There is no pearl in any royal crown for which a young queen would give one of her front incisors. The teeth, in their relation to the beauty of the human countenance, have figured in poetry from the earliest times. Their whiteness has been compared to that of snow, of Parian marble, and of pearls, until verse is tired of the images. The ancient poets and satirists are full of allusions to the beauty and deformity depending upon the condition of the teeth. Men can conceal the imperfection of the dental arrangements by letting the eaves of a heavy mustache overshadow their mouths. But to women, to hide whose smile would be to take away half the sunshine of life, and to whom Nature has kindly refused the growth that would deprive us of it, there is no element of her wondrous beauty which can take the place of white, even, well-shaped teeth. And as beauty is not a mere plaything, but a great force, like gravity or electricity, the art which keeps it, mends it, and, to some extent, makes it, is of corresponding importance.

While dentistry, as Dr. Holmes has said, plays an important part in keeping and mending the beauty of the face by means of the treatment and care of dental deformities, it also plays a very important part in preserving such beauty by the prevention of threatening disease in the mouth before it occurs.

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Dentistry, like medicine, is then really a suicidal profession, for its fundamental purpose is to find out the real reasons behind all dental disease, get rid of such disease through preventive measures, and thus bring about the ideal state where no dentistry will be needed. Such a state is what dentists are working for; but it is a long way off as yet, and it cannot possibly be reached until every one cooperates with his dentist to the fullest possible extent.

If everyone knew the true facts about the development of the teeth, much suffering from all kinds of disease in the mouth could be prevented. Few realize that the teeth of the unborn child start to form in the jaws at the fourth month of pregnancy, and, that being the case, it is extremely important for the mother to have the right kind of diet to develop strong teeth and bones in her child. The prospective mother, then, has a great responsibility. The whole future health of her child may be affected by proper care or lack of it at this important time, and therefore she should visit her family dentist and her family physician early in pregnancy to find out what she should eat in order to benefit her child to the fullest extent. Percy R. Howe, director of the Forsyth Dental Infirmary for Children, has proved conclusively that a mother's diet is one of the most important factors in the sound development and growth of her child.

At approximately six months after birth, the first teeth make their appearance through the gums. This set consists of twenty teeth, all small, to harmonize with the small features of the baby. At this time, diet also plays an important part in the care of the very young child, for while the mother or father may not realize it, the permanent teeth, which are not cut until some years later, are being formed in the baby's jaws. Hence, two things are of great importance during the first six years of the child's life, among other things, to ensure strong healthy teeth throughout life and to prevent possible serious disease in the mouth: (1) a strong tooth-building, bone-building diet to make for strong permanent teeth in later life, and (2) careful attention to the temporary teeth.

Many parents say, "Don't bother to take care of the baby teeth, as they will be lost in a few years anyhow." Such a statement is very unwise; for unless these baby teeth are taken care of and watched almost from their first appearance, much serious damage will result in later life. Decay of baby teeth makes it very hard for the child to chew proper foods, and leads to the use of improper diet, with all kinds of complications bound to result. The child may suffer from various disorders of the stomach from the use of improper foods, and if the baby teeth are lost through disease or decay, the permanent teeth will come through the gums crooked, deformed jaws resulting in later life.

Thus, it is of the greatest importance for a woman to consult the dentist early in pregnancy, and also to take her child to the dentist not later than its second year in order to make sure that she and her child are taking full advantage of preventive measures.

This brings me to my second point: what modern dentistry should do for you, that is, if you will but give it the chance.

Modern dentistry, in cooperating with the family physician, can give the prospective mother proper diet for the building of strong teeth and bones in her unborn child. Modern dentistry can take care of the baby teeth of the young child so as to ensure the cutting of a good set of permanent teeth in later life. And if

you have not taken advantage of preventive measures in your child's early years, and it develops crooked, twisted teeth or malformed jaws, giving it the appearance of either a bulldog, with the protruding lower jaw, or Andy Gump with the receding lower jaw, modern dentistry can take care of that, too. It can take young children, between the ages of 6 and 14 years, and it can straighten crooked teeth and pull the jaws into proper position so that the child can get the most efficient use of the teeth which Nature has placed in its head.

And also, in later life, if the permanent teeth have been lost through disease or decay, modern dentistry can restore missing teeth in the mouth by means of plates, crowns and bridges, so that the grown person can get the full benefit of his chewing apparatus.

The third and last point that I wish to stress is the effect of teeth on personality. Did it ever occur to you that your whole career might be ruined by your teeth? This seems a harsh statement, but it is true. I can cite several instances to back it up. Within the last year or so, at least a half dozen girls have come to one of the prominent dental clinics seeking to have crooked teeth straightened, and every one of them said, "In going after jobs we find ourselves at a big disadvantage on account of our teeth. We simply can't compete with girls who have good looking teeth, whether we really know more about the work or not, and we want to know if something can't be done for us, to straighten our teeth, so that we can get good jobs as other girls do." And I can cite many other cases of the same sort.

People with bad looking teeth, then, are going through life with two strikes called on them before they even step up to bat. Success in business, at teaching, at public speaking, on the stage—in practically every walk of life—demands personality, and one of the most important parts of personality is the person's smile, and that means the appearance of the teeth.

So what I have to say to you is this: Stop for a moment and consider what lies ahead of your child and yourself! Can you really afford to lose out at the start through bad teeth? Do you want your child to lose out through bad teeth? Of course not! Then go to your dentist; talk the situation over with him before it is too late; go to see him regularly, and especially when you think you have some trouble with your mouth; and let him straighten your difficulties out for you. If in doubt, let your family dentist decide. He can really help you if you will let him.

DENTISTRY AS A HEALTH SERVICE*

By FRANK DELABARRE, A.B., M.D., D.D.S., Boston, Mass.

IN order to understand the present radical changes in the practice of dentistry, it is necessary to review briefly its history. The three main periods of development, each of which has its dominant characteristic attitude, merge into each other almost imperceptibly. We are now in the midst of adjustment to a new perspective of enlarged responsibilities which the public should understand, and the emphasis of this talk centers on that.

The first period, dating from earliest times, is characterized by the efforts of individual craftsmen, with a degree of finger skill, but without any knowledge or appreciation of the problem beyond the mechanical treatment. Our own Paul Revere was one of them, and to his many accomplishments he added skill in making artificial teeth.

The second period begins with the founding of the first dental school at Baltimore, in 1840, which marks the birth of the profession.

The outstanding characteristic of the following years is naturally an astounding refinement of all the intricate mechanical procedures used in the work, taking full advantage of the rapid increase in all scientific knowledge.

It was during this same period that medicine made its most rapid development, and its influence on dentistry is shown, in later years, by the adoption of a new objective, the health of the teeth and mouth.

The third period began in 1912 with a terrific attack on dentistry in a public address by an English physician, Sir William Hunter. He asserted that dentists had emphasized too much the mechanical skill, building on a foundation that left diseased areas in and about the teeth, local inflammation and abscesses resulting.

Worse than that, he also asserted that the poisonous products from these areas were absorbed into the system and were directly responsible for affections of vital organs, such as heart disease, rheumatism and a host of diseases that seriously impaired the general health and threatened life itself.

Immediate and vigorous protests from our profession availed nothing, but scientific men attacked the problem and soon satisfied themselves and the profession regarding it.

Out of that battle has emerged a new dentistry, with a new objective, a wider horizon and vastly greater responsibilities: Dentistry, a health service, the maintenance and restoration of the health and function of the mouth, not for its own sake alone, but also for the sake of general health.

The most common dental disease is decay of the teeth; in fact, that is the most common of all diseases. The results of neglected decay are responsible for most of the serious conditions that

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finally produce unhealthy oral conditions and contribute to a lowering of general health.

For the repair and control of such decay, we will use the same generally admitted technical skill, but only after a more careful and complete diagnosis of the local disturbance as related to the other bodily organs and functions.

There will be fewer diseased or questionable areas left in the mouth as a foundation for our work. Mouths will be healthier and will function better.

But we are not content with that important advance, but are stimulated by the wonderful results in prevention attained by medicine in recent years in the elimination or control of diseases that formerly took a heavy toll of human lives. Today, the occurrence of smallpox is rare; typhoid and diptheria show a marked decrease in the death rate; the Panama Canal would never have been built had not yellow fever been conquered. These and similar achievements have resulted from the discovery and elimination or control of the cause of each disease.

So we are using every effort to prevent decay and dental disease. No one but a dentist can know and appreciate the vast amount of it, and the tremendous odds against the attempt to control it, once it has occurred. To be sure, there is a measure of prevention in the successful filling of every decayed cavity, in every restoration that reestablishes mouth health and function. But that is really a hopeless task, as far as public health is concerned, because of the amount of work to be done and the fact that the problem is being attacked from the wrong end. It is not rational or logical.

Can we prevent decay? Today, we cannot, because we do not definitely know its cause or all of the contributing factors in it. The problem is being scientifically studied by our research men, and we have confidence that it will be solved. Discovery of the actual germ or germs suspected will be a big step, but like all such intricate human health problems, many things must be considered. Balanced diet control offers great promise for the building of stronger, more resistant teeth. But we have not enough accepted fact on which to found a preventive treatment.

However, there is great encouragement to be derived from recent intensive study of decay, its occurrence and history, and many facts have been unearthed that point to a method of practical control which even carries with it a degree of prevention.

Some of these facts are as follows:

1. Decay is essentially a disease of childhood. The danger decreases with age.

2. Many teeth are found to be imperfectly formed because the enamel covering is not fused together. These defects are called pits and fissures.

3. These defects are found on certain surfaces of the teeth, the surfaces and teeth in which decay is first and most frequently found. The baby teeth as well as the permanent teeth have these defects.

4. These defects are not to be detected by the eye and only a fine instrument will reveal them, but they are large enough to harbor hosts of germs which undoubtedly are concerned in the process of decay.

5. Decay attacks the softer layer under the hard enamel before there is any visual indication of its presence, by which time the damage has become serious and much more difficult to control.

Reasoning from these facts, it is apparent to us that if all defects were attended to soon after the teeth appear and before decay starts, bacteria would find it difficult to gain a foothold. Since there are no nerves in the enamel, that can be done without pain at any time. It may truly be said that such a procedure would be preventive.

The inevitable conclusion is that dentistry for children can most easily control decay and, also, to a degree prevent it. The remedy is applied nearest to the time of the beginning of decay. Such reasoning is supported by logic and common sense.

Dental societies throughout the world have endorsed a set of resolutions which were first formulated and adopted in Massachusetts in 1926, relative to this whole question, and the following quotations and remarks should convince you that the ideas expressed represent the united opinion of organized dentistry: "Dental service, to be effective in prevention or control of decay, must begin early in childhood and be periodic and systematic."

That means dentistry for children. Decay is a disease of childhood, and it is advocated that such service should begin not later than the age of 2½, when the baby teeth are all in place. The service should be periodic and systematic in order that defects may have attention as soon as possible after each pair of teeth erupt, which occurs at frequent regular intervals. The dentist should tell you how often to come and that will be not less than four times a year. If faithfully followed up, this amounts to insurance against dental trouble.

Again quoting:

"The baby teeth should receive as much care as the permanent ones in order to promote the proper development of the jaws and head and to maintain function.

"Particular care and attention should be given to developmental pits and fissures, whether in the baby or permanent teeth or whether decay is or is not present.

"This Society 'declares for the principles and practice of children's dentistry and maintains that the most effective dentistry that can be done for any individual is the service rendered between the second and fourteenth year of age.' "

Reliable figures show that Massachusetts children entering school at 6 years of age have an average of eight cavities each, and over one abscess apiece. That is a terrible handicap at an age of rapid growth and development, when a child needs nourishment not alone to maintain life but also to provide material for additional bone and muscle cells. Not only is function seriously impaired, but also the threat of disease is a source of great danger to bodily health. Heart disease in children is increasing, and a possible cause lies in just such conditions.

There can be no question of the benefits to the child of early and periodic dental attention in the improved health of the mouth and the consequent removal of harmful influences on bodily health.

Through our ignorance, the child has hitherto been neglected and we have given bad advice and worse service. We now believe in giving the baby teeth most careful and skilful attention. Our leading men are getting excellent results in terms of health for their little patients.

We need the cooperation of the public in seeing the children early, before decay and toothache drive them to seek our aid. Forget your own distressing experiences in the chair, and believe me in saying that children need not fear nor dread our ministrations, provided you

follow this plan. They make the best of patients, if fear is not instilled in them from what they learn outside.

This is no plea for more patients or more fees, because it is absolutely true that a child can be brought to maturity at less cost under this plan than by waiting for trouble to develop before bringing him in; and there is no comparison in the health results to be obtained.

There are many things the dentist can do besides cleaning and filling teeth, such as giving instruction in home care, which is very important, and in early detection of habits which have a bad influence on growth and health. The worst of these is mouth-breathing, because it affects the lungs and the whole body, and increases the liability to infectious disease.

You may be assured that if your child follows this plan, his health will be vastly better, and there is a strong probability that he will escape, to a large degree, the discomfort, pain, abscesses, extractions and replacements you yourself have undergone.

This is dental health service.

THE BUILDING AND UPKEEP OF THE DENTAL MACHINE*

By E. MELVILLE QUINBY, D.D.S., Boston, Mass.

YOUR attention is invited to another variation of the tooth motif, the keynote of which is simplicity. When one begins to talk about reducing problems to a simple basis, the fact is soon apparent that the simple is very hard—there are so many bypaths and pitfalls for the unwary.

I am reminded of the story of an English sportsman who set out to buy a horse. To find a suitable one, he paid a visit to a well-known horse dealer. The latter asked the prospective buyer into the stable, and began to tell about the pedigrees and family histories of several animals therein. After a while our sporting friend got impatient, and said, "'Ere Guvner, cut out the blooming cackle and let's get to the 'osses." I propose to cut the cackle and get to the 'osses; and our first thought is health.

Carlyle once said, "Health is the real basis of morality and of all religion." In this day and age, every man, woman and child can help themselves to health, but we cannot expect to be healthy unless our mouths, which are the gateway to our bodies, are in a healthy condition. For mouth health, not only the teeth but also the gums, must be considered. If you build a house on a swamp, you know what will happen. No matter what fine materials you put into the house, and how beautiful its outside appearance is, if the foundations are not sound, the house will fall down. There are thirty-two teeth in a normal mouth, and each and every tooth has a duty to carry out, which is to grind and chew food; and this can be done only if the teeth are strongly built and well supported by the gums.

The duties spoken of are the same in any kind of machine. I am going to use the automobile to illustrate my point be-

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cause I don't believe there is any person in the world who does not know all about the automobile.

What are the necessary factors in the running of an automobile? 1. The frame work must be built to stand wear and tear. 2. The mechanical parts must fit each other to ensure smooth working. 3. The parts must be kept cleaned and oiled to prevent rusting. 4. An automobile must undergo repairs from time to time.

In the case of the dental machine, both teeth and gums must be strongly built by eating the right kind of food. Women during pregnancy must eat foods that will provide the elements for bone and tooth growth for the baby, as well as to ensure tooth health for themselves. In other words, prospective mothers must eat for two, and so banish for ever the old idea that child bearing must always mean loss of teeth for the mother.

After birth, proper feeding of the infant, which, of course, is breast feeding, will supply the proper elements for growth; and the action of nursing will give exercise to the muscles of the baby's face, and help the growth of the jaws so that when the teeth come they will find there is plenty of room.

After the teeth have erupted, they must be kept clean and free from germs.

Keep in mind that all three factors in building and upkeep of the dental machine must be cared for. One of the many mistakes in the past—one of the reasons for failure to prevent dental diseases—has been that a single cause was sought. It is true that good results may be obtained from a treatment based on correct diet *alone,* or from careful attention to the arrangements of teeth to form a smooth working machine *alone,* or, again, from a thorough cleaning of the teeth, with removal of germ laden deposits *alone*. But we are more likely to obtain one hundred per cent results from attention to all three factors.

For special advice to all prospective mothers on the right kind of food during pregnancy, we hope to get the help of all the family physicians in the country. The dentists should call the attention of prospective mothers to the necessity for correct diet in pregnancy and see that they all get such advice. All health workers, medical nurses, dental nurses, social workers, school teachers, parent-teacher organizations and industrial bureaus can take a hand in this movement.

For the latest information about diet, apply to the Department of Hygiene, State House, Boston, or to Massachusetts Agricultural College, Amherst, where most admirable work is being done for the community by both, and whence health pamphlets can be obtained.

For general instruction in the development and upkeep of the dental machine, the clinics in operation at the Harvard and Tufts Dental Schools and the Forsyth Dental Infirmary for Children should be remembered, as they are all doing good work in these respects.

Do not forget that "because a thing has always been done a certain way is no proof that there is not another and a better way."

In order to attain results desired, I am asking the audience, especially the ladies, for reasons to be explained later, to allow their minds to be open to what may seem to be a new point of view to many.

It will be admitted, I think, by all that of the many desires common to the human race, the most common is the wish for good health. Unless we are physically fit, we are not in a position to attain the good things of life. Furthermore, a man's value to the community is in direct ratio to his health.

In the last few years, which might be termed the Age of Hygiene, frantic efforts have been made to educate the community on lines of physical culture, the laws of right living and "How to keep well." The health campaign, carried on through lectures, essays, books, magazines, moving pictures, or newspaper articles, seems to have covered almost the entire field of the human system. In many respects, the fight against disease has been successful, such dread maladies as smallpox, yellow fever, typhoid and diphtheria to a large extent having been checked.

The fact remains that the causes of decay in teeth and disease of the gums and tooth sockets are still wrapped in mystery, and until we have arrived at the stage of knowledge and experience which will help us to steer clear of the fog of doubt and the bypaths of uncertainty, we cannot set our feet firmly on the road which leads to prevention.

To attain this end, we must start at the beginning of life: and that is why the help of the women of the country is especially desired, because, in my scheme of things, mothers are the most powerful factors in the success of the plan. They are the ones who have most to do in bringing forth and caring for the children. So far, I have talked on the general principles of the plan of campaign, also the need for proper attention to building our dental machine. Let us spend a little time on the third factor: cleaning and oiling.

Judging from the mass of literature on the subject to be found in medical and dental journals and also in the health columns of our newspapers, we might suppose that the era of hygiene had arrived.

True—much advice is given, but how much is followed? And again, how much is worth following? By this is meant that, after all, few health problems are really solved to the satisfaction of the majority, and we are very apt to follow instructions only in part and take a great deal for granted. For instance, we talk glibly about clean teeth and clean mouths; but the man from Missouri will inquire, "Who ever saw a clean tooth or a clean mouth?" meaning, of course, surgically clean.

Be it remembered that there are four to five surfaces on each tooth; that each tooth has a trough around it to an average depth of 2.3 mm.; that the tongue, especially at the back, is well adapted to catch and hold débris and that quite nearby are the tonsils. Bearing these facts in mind, it behooves us to be careful about claiming complete cleanliness of all these tissues named.

I shall try to give a description of twenty-four hours in the mouth, and roughly portray conditions which prevail in the majority of cases. I would point out, however, that herein is intended no slur on the habits of the people or their desire for cleanliness, as we fully realize that neglect of dental hygiene is the result of almost universal ignorance as to the whats, the whys and the hows of the subject.

We will take, for example, the average man of affairs and his probable tooth-cleaning program. We will suppose that such a man stays in bed until the last possible moment, and that having at length separated himself from the blankets, he proceeds to make his toilet as quickly as possible. Included in the program is a cleaning of teeth: with what? A bristle brush, which possibly has been left on the shelf in the bathroom, is far from dry and efficient and has certainly never been sterilized. With this weapon, he makes a few half-hearted motions on

the lip and cheek surfaces of the teeth, generally more on one side than the other with the favorite dentifrice of the moment, and having spent about twenty to thirty seconds on the job, proceeds to the breakfast table.

A sample meal might be as follows: Orange juice or grape fruit, a cereal, cooked, such as oatmeal, or uncooked, as corn flakes; eggs and bacon, bran muffins, and coffee. In other words, fruit juice, starches, protein and fats.

The result as a rule is that portions of the various foodstuffs are gummed round the necks of the teeth; in the depressions of the biting surfaces; in cavities in the teeth, and in fact in any recess in the mouth, and also, last but not least, on the back of the tongue. Note: Starches ferment and animal food decomposes three to four hours after eating. To counteract such processes, we should clean the teeth, the gums and the tongue directly after eating. But the cold fact remains that the average subject of our sketch has a train or trolley car to catch in order to reach the office in time for business. So no mouth cleansing is done, and the fermentation and decomposing processes commence and proceed without hindrance.

The midday meal is taken in town; and where do you find facilities for mouth hygiene in town? So a new process of fermentation is commenced, adding the proceeds—billions of germs—to the first attack of the day. The evening is, we will suppose, spent at home. Does our friend go from the dining room directly to the bathroom and spend five minutes in mouth hygiene? Perhaps. As a rule, he is tired and seeks refuge in the favorite armchair, or perhaps takes the family to the movies. In any case, the same old process of germ culture goes on for the third time that day and then between 11 p.m. and midnight a half hearted mouth toilet of a few seconds may be made. Is this an exaggerated picture?

It has been calculated in the biochemical workshop of Columbia University that a milligram of débris from spaces between teeth may contain from 6,000,000 to 8,000,000 germs in a fairly well kept mouth, but, in a dirty mouth, the same milligram may contain 600,000,000 to 800,000,000 germs, and yet people do not really clean their teeth, or their tongues day in day out, year in year out; and they wonder that they have all kinds of diseases.

The mouth presides over the entrance to two most important systems, the breathing and the digestive, and, as Dr. Hyatt reminds us, isn't it only horse sense to keep it clean?

There is no time in this talk to dwell on details of building, fitting or cleaning. I would suggest that every man, woman and child ask the dentist to show each one the right kind of tooth cleanser; and the right way to use it; and also to advise the suitable mouthwash, powder or paste, any one or all three according to the case.

Do not forget that your dental machine has three factors: building, fitting and cleaning, and that each factor is just as important as the others.

DIET*

By RAEBURN R. DAVENPORT, D.D.S., Boston, Mass.

ONE of the subjects in which dentists are especially interested is diet. Through diet, we have the way to a healthy mouth—which means good strong teeth and healthy gums—principally through food, and through a healthy mouth, a healthy body. Expectant mothers must pick their foods, not only to care for their own teeth and gums, but also to build strong bodies for their children. The teeth of the baby start to form about six months before birth. After the baby is born, mothers must select the foods for their children very carefully, for although the baby's teeth are gradually pushed through the gums, the growth of these teeth and the jaw bone is *most* important. The baby teeth are not fully formed when they first appear, and must be kept in good condition. Vigorous chewing will help develop good jaws, with plenty of room for the permanent teeth which will come later, in place of the baby teeth. They must also be strong and in good condition to help develop the nose and throat, which will aid in good breathing, and help to avoid the development of abnormal tonsils and adenoids. Foods that babies and young children eat have a very definite bearing on the structure and growth of the permanent teeth, which start to form about the time of birth, and still are forming and developing for months after they come through the gums, that is, from 6 to 12 years of age. After these teeth are through the gums, coarse-fibered foods further develop the bones in the jaw, and a balanced diet will further the growth of the bones, teeth and gums.

We grown ups must select foods to cleanse our teeth, strengthen the bones, teeth and gums, prevent and cure pyorrhea and other gum diseases, such as "trench mouth."

What are those foods? It would take time to name them all. Go to your dentist, and he, with the cooperation of your physician, will make out some sample menus that will contain the foods needed in your case, and will also be a balanced meal.

I might add here that balanced menus with special reference to the teeth and mouth for all ages can be obtained from Washington, our own State Houses, the Massachusetts Agricultural College and the Forsyth Dental Infirmary. In general, from our point of view, the foods containing minerals, such as lime and phosphorus, help to build the teeth. The vitamins—from A to G—help directly and indirectly to build and maintain health of the teeth, gums and bony structures of the mouth. Foods containing calcium in abundance, milk especially, are very important. Although some of the vitamins can be stored in the body, it is unwise to depend on this reserve. We do know that vitamin C, which has especial value as regards mouth health,

*Broadcast over Station WEEI under the auspices of the New England Dental Society.

cannot be stored. For this reason, it is necessary to eat foods every day containing vitamin C (raw fruits and green vegetables contain this vitamin in abundance), the best of which are orange juice and raw cabbage. Lack of this vitamin very often causes pyorrhea. Modern treatment for this disease includes a diet like the following: 1 pint of orange juice, or better still, its equivalent in oranges, 1 to 3 tomatoes, 1 banana and at least one serving of raw cabbage. Lemonade may be substituted for part of the orange juice. Fruits, vegetables, eggs and milk are the most important foods in preventing decay and maintaining mouth health.

Research work on rats indicates that falling hair and the early onset of old age can be prevented by the use of vitamin G. The principal foods bearing this vitamin are milk, eggs, fruits and vegetables.

We have also learned more about the different anesthetics, that is, the medicines which are at our disposal for numbing the pain while we are working on or taking out your teeth. These included nitrous oxid and oxygen and procain, which is given by injecting around a particular tooth in the upper jaw, or by nerve block in the lower jaw, where a main nerve can be numbed. In this way all the teeth connected with the nerve will be affected, which means half of the teeth on the lower jaw. Ethyl chlorid is well adapted to work with children.

The gold inlay is a great aid when the cavities in your teeth grow large, which, of course, they should never do. We can put in a filling that can be carved to very nearly the shape of the original tooth. This will be strong and safe, insuring good edges to the filling, so that food will not collect around, on top of or between the teeth. It also makes an ideal filling when we need added protection for the nerve.

Surgical operations on the jaw bone, teeth and gums, including skin grafting bring out more forcibly the fact that we cannot be too careful in the care of your mouths. Most of you know that abscessed teeth should not be tolerated in your mouths. All kinds of diseases of the bones, muscles, nerves and vital organs can be caused by abscessed teeth or a dirty mouth. It behooves you to have a thorough examination, including x-ray films, by your dentist, with the cooperation of your physician, if you have any pain or swelling in any part of your body.

The orthodontists, the dentists most interested in straightening crooked teeth in children, have many different ways of moving the teeth in the jaw, and developing the jaw bone. The modern appliances cause a minimum amount of discomfort to the patient. Getting the different teeth into their proper places not only makes the child's teeth, mouth and face look better, but also insures the child a well-formed machine to chew its food. This also develops strong jaws, well-shaped roofs to the mouth, roomy nose and throat passages, good teeth and healthy gums.

An improved method of using the x-ray has been brought out that will help us in diagnosis, which is the foundation of our work and program, as are the blueprints and plans in the case of a house. Not only do they show us work to be done, but also often locate conditions that may be causing other troubles.

Through the use of porcelain, we now have a method of changing hideous, discolored or gold teeth to beautiful naturally colored porcelain teeth. Methods of staining false teeth, to bring out spots or

old fillings that were on the original teeth, show art that could be compared to a Rembrandt's.

All in all, we have learned what a wonderful opportunity we have to help each person by building a good chewing or dental machine, free from the poisons that cause body ills.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Laryngology in Relation to Disease of the Hematopoietic System: Purpura and agranulocytosis are discussed by Claude L. LaRue (*J.A.M.A.*, Sept. 26, 1931) in a study of the laryngologic aspects of diseases of the blood-forming system. Lesions of the nose and throat are to be seen early in the development of the hemic dyscrasias, purpura hemorrhagica and agranulocytic angina, conditions in which thrombocytes and granulocytes, respectively, almost entirely disappear from the blood. It is thought that behavior of the living organism during their absence may throw added light on the function of these cells. That platelet scarcity in purpura is due to failure of regenerative processes is suggested by response to measures known to stimulate blood production, such as transfusion; while removal of the chief catabolic agent through splenectomy favors the theory that the condition is due to overactivity of the degenerative mechanism. Of six patients, severe bleeding from the nose, throat or gums occurred spontaneously in four, in two postoperatively. In one case coming to necropsy, there was no pathologic change in the bone marrow, but marked toxic splenitis, changes in the capillary endothelium and necrosis of the mucous membrane. The author quotes Coke in support of his theory that the condition is caused by infective organisms, probably streptococcal, gaining entrance through the nasal or pharyngeal mucosa. In agranulocytosis, the blood deficiency is confined to the leukocytes. About 150 cases have been reported, although the condition has been recognized for only a few years. In the mild type, recovery is the rule; in the severe type, the mortality is 90 per cent. In both types, there is leukopenia, affecting principally the granulocytes, the red cells and platelets remaining normal. Recurrence is common. The condition is to be differentiated from streptococcic throat conditions, acute follicular tonsillitis, Vincent's infection and diphtheria. Ulcers having a clear cut margin surrounded by a noninflammatory area are characteristic of the disease, with a generalized edema making breathing and swallowing difficult. To the two theories, cell nonproduction and excessive cell destruction, the author adds a third, functional depression of marrow cell activity from infection. He regards as quite significant the finding of *Bacillus pyocyaneus* in local lesions and occasionally in blood cultures. Treatment seeks to rid the system of toxins and to stimulate bone marrow activity. The author says: "In accomplishing the latter, irradiation has great possibilities, but since granulocytic regeneration is confined to the red marrow of the short rather than to the yellow marrow of long bones, the treatment should be applied to the former. Experiments have recently proved conclusively that irradiation increases the number of reticulocytes and red cells. Transfusion, like foreign protein injection, should have favorable mention, as a limited period of increased stimulation follows. Arsphenamines are condemned because of their well-known depressant action on the hematopoietic system, having frequently caused even fatal leukopenia. Nucleotide therapy, as advised by Reznikoff, seems to have merit. He has successfully used adenine sulphate and guanine hydrochloride in three cases and also has proved that they stimulate production of granulocytes in experimental animals. In severe granulopenia, multiple abscess formation has occurred simultaneously with increase of neutrophils and did so in our first case. It has led Roberts and Kracke to regard 'sepsis or sterile abscesses as the best therapeutics so far offered.' Abscess formation is always accompanied by a trend toward leukocytosis and

its intentional production, though requiring courage, merits consideration." The author regards it as possible that certain unexplainable states of physical and mental depression, so-called nervous exhaustion, neurasthenia, and the like, are due to a lack of granulocytes, caused in turn by infection gaining entrance through insignificant pharyngeal lesions. That there is an opportunity to determine more definitely the function of the granulocytes within the field of laryngology is an added reason why examination should include, as a routine, a study of the blood.

Persistent Trigeminal Neuralgia: A case of trigeminal neuralgia continuing for a period of four years is reported by Watson and Michaelson *(Brit. Dent. J.,* Sept. 15, 1931). The patient, a man, aged 62, developed the condition in a few days after he had suffered a severe blow on the right side of the mandible. The point of acute pain was the region of the second bicuspid. During the attacks, over which anodynes had no effect, it was with difficulty that those around the patient kept him from injuring himself and others. Roentgen-ray examination revealed a sequestrum in the painful area. This was removed under general anesthesia, and the resulting cavity cauterized and the wound closed with catgut sutures. After seventeen days, the case was dismissed. The following day the pain returned in greater intensity, extending into the temporal and occipital regions. Several unhealthy teeth were then removed, with no effect. There was a rapid loss of weight and the general health was poor. An incision was made over the outer aspect of the affected region down to the bone, the periosteum stripped off, the bone scraped and the resulting cavity packed with acriflavin gauze. The wound healed, but the pain soon returned, the attacks now resembling those of epilepsy, with frequent recurrences. Between attacks, the patient was normal and showed no mental deterioration. He continued to visit the dental department for treatment, and every new dental house surgeon reviewed the case, and made new roentgenograms. ". . . the injections of absolute alcohol into the main truck of his mandibular nerve were sufficient to cause atrophy of the biggest nerve in his body, but still his epileptic-like attacks kept on returning." He was gradually made edentulous, and the bone was scraped under a local anesthetic, but without improvement. The case came to be looked on rather as a mental one, one phase of the case supporting this theory being the fact that there were never any attacks when the patient was attending a football game, of which sport he was an ardent devotee. He was also able to enjoy uninterrupted rest at night. As he continued to come to the dispensary begging for relief, he was again referred to the surgeon, and under a general anesthetic, an incision was made over the masseter muscle at its attachment to the ramus of the mandible, the muscle was cut in the direction of its fibers, the bone was trephined, about three-quarters inch of the mandibular nerve was exposed and cut in two places, the intervening bit of nerve was removed and the free edges of the exposed nerve were then cauterized, the masseter muscle was stitched together and the overlying skin stitched also. Twenty weeks after the operation, the patient was still free from pain, putting on weight and planning to return to work.

Oral Hygiene and Dental Caries: In the line of preventive medicine there is perhaps no subject which is more fully brought home to the public nor of which, fortunately, the individual is now more cognizant than that of the health and care of the teeth. This popular education in mouth hygiene and dental care is of course due in great measure to lay advertising propaganda relating to tooth paste, powders and other cleansing paraphernalia as well as various mouth washes, gargles, sprays and what not which are showered upon us with warnings, threats and direful prognostic eventualities as to our teeth, and their influence upon our social status, financial position and life in general, if we do not regularly use a particular brand of dentifrice, brush from below upward, and see our dentist twice a year. The results certainly prove the value of advertising. Fundamentally it is a most commendable idea to instruct the laity in this particular form of health preservation, but through the means employed by modern high-pressure salesmanship and advertising, to promote sales, it is evident that considerable nonsense is being disseminated. We are cautioned, premonished and shouted at concerning the misleading "one out of so many" pyorrhea hazard; the terrible coating of disfiguring and dangerous film; the pink tooth brush horror; the alarming softening of the gums through lowered "surface tension"; the "danger line"; the peril of the "acid" mouth and God only knows what else of the best-friend-won't-tell-you variety of nonsense.

There is no reason why a really good mouth wash, or dentifrice, should not have a most important place in the scheme of oral and dental hygiene and be of much value. The trouble is with the extravagantly silly claims by which many of these products are extolled to the public. The American Dental Association is feeling this way about the matter and is trying to get various manufacturers to see the light. Proper oral and dental hygiene is most emphatically necessary in the prevention of deterioration in appearance and structure of the teeth. In addition, it is to be remembered that in the etiology of dental caries, heredity or inheritance, environment, personal hygiene, individual constitutional make-up, kind of food—with its tendency to fermentation—proper mastication, various chemical and bacterial actions are some of the most important factors; so important are these things that simply brushing the teeth in the right direction with the best dentifrice will not of course end the story. Discussing some of the factors relative to focal infections, prevention of oral sepsis, dental caries and pyorrhea, L. F. Barker, M.D., in "The Function of the Dentist" (*The Journal of Medicine*, Cincinnati, July, 1930), notes that it is essential to forestall a carious condition of the teeth which is followed by injury to and death of the pulps and "to prevent gingivitis and infection of the gingival crevices with pathogenic microorganisms" in order to prevent a septic oral condition. In this effort he aptly points out that the factors of inheritance, environment and individual constitution, as well as a combination of these factors are very important considerations. Regarding dental caries, W. D. Miller is mentioned as explaining how the enamel of the tooth is affected by acids, resulting in loss of the lime content, leaving the then vulnerable dental surface open to bacterial attack with subsequent chemical action which extends to the pulp and peridental structure. The fact that the molar and premolar teeth are the more frequently affected by carious processes has been ascribed solely to the action of acids over sufficient length of time upon the lime element of the enamel of these teeth; but this explanation does not satisfactorily show why other teeth are comparatively unaffected by acids. The molars, however, appear to be the sites of predilection because of minute depressions in the surface enamel wherein particles of food are caught and held, giving rise to an acid fermentative destructive process. Soft foods, consisting chiefly of sugar and starchy elements, calling for limited mastication, and which favor a form of lactic-acid fermentation, are held as important etiologic factors in the production of dental caries. These foods are more readily retained in the surface irregularities of the tooth and in the adjoining crevices, and while causing softening of the enamel, offer fertile media for untoward chemical action by the bacteria present in the mouth. The coarser foods, such as meats, containing an excess of fibrous material, and other varieties of food, with the cellulose element predominating, require greater mastication and thus, being more fully removed from the depressions, or pits, upon the tooth surface and from the interspaces, do not tend to act as productive agents of injury to the enamel. The increased mastication necessary in disposing of these heavier foods acts as a mechanical, and also by stimulation of the salivary flow, chemical, cleansing agent; therefore, soft foods should be followed by the more coarse or fibrous kinds. Barker states that dental caries "always begins on the external surface of the tooth" because of the factor mentioned, and, that while admitting the importance of constitutional etiologic factors "there seems to be good reason to believe that, if carbohydrate stasis with acid production could be prevented in the mouth, a very large percentage, if not all, of caries of the teeth would fail to occur."

The Constitutional Factor in Dental Caries

So much for the external or local causes of dental caries. It appears, however, that the constitutional factor, or state of the individual general bodily health and resistance, is coming in for intensive consideration. The teeth, just as any other special body tissue, or structure, are obviously dependent for their normal health and function upon the correct underlying physical condition of the entire organism; when such entire physical body is below par in health and activity, the teeth are affected from within, due to improper or insufficient vital nourishment. It is interesting to note, in connection with the theory that decay of the teeth is a disease due to disturbed conditions within the tooth, brought about, as pointed out, through lack of nourishment, improper or lost nerve, blood and lymph supply and structural elements, that intensive investigation along these lines of approach to the

subject of caries is to be carried out. According to reports in the daily press a short time ago, over one hundred thousand dollars has been appropriated to cover research work, over a three-year period, at the school of dental and oral surgery of Columbia University, New York City, in an effort to more effectively clear up the etiology of dental decay. Dr. Charles F. Bodecker, professor of dentistry, Columbia University, is credited with stressing the theory, to be worked upon in this research, that carious teeth result from intrinsic disturbances, which are evidently pathologic, rather than from primary external causes. This theory is more or less substantiated by the facts that teeth which are kept scrupulously clean do, nevertheless, undergo deterioration and decay and that to a great extent healthy teeth have natural inherent, active protective defenses against caries without the assistance of tooth brushes and cleansing adjuvants. The program of the research work scheduled at Columbia does not, however, cast aside the importance of the acid elements which attack the tooth surface and which are produced by fermentation of the retained fragments of food, but rather aims to discover a way of overcoming such undesirable acid effect through neutralization or other counteraction, from within the tooth structure itself. Such a means of combating dental decay would appear very rational, as it is obviously impossible to sufficiently and completely clean all tooth surfaces, and, also, because the cleaning adjunct which is employed is very quickly disposed of by the mouth secretion. The scope of the proposed study is intended to combine efforts along the lines of clinical medicine, physiologic chemistry, bacteriology, dietetics and allied branches. This procedure is in itself a long step in the right direction, as the dentist, medical practitioner, laboratory worker, technician, etc., must get together on the proposition. Of course, if we do eventually find a way of having the tooth take care of its health and well-being from within and with less aid from the outside, except proper dental supervision and scientific care, it will be a terrible blow to those rabidly shouting dentifrice manufacturers whose claims are often so absurd. One thing now seems to be more certain and that is that the physician and dentist must and will more closely cooperate in the endeavor to accomplish something definite relative to the etiology and treatment of dental caries. This condition, in the environment of our modern life, is far too prevalent to be considered as a one-man problem for solution.—*American Medicine,* January, 1931.

MISCELLANY

BOOK REVIEWS

General Bacteriology. By Edwin O. Jordan, Ph.D., Professor of Bacteriology in the University of Chicago, and the Rush Medical College, Chicago, Ill. Tenth Edition, entirely reset. 819 pages with 200 illustrations. Cloth, $6.00 net. Published by W. B. Saunders Company, Philadelphia and London, 1931.

Bacteriology is constantly assuming a more established status in the minds of those who have to do with disease processes. During every day of a dentist's life, there is something of intimate association with this subject, and while little is said in this book regarding the bacteriologic factors specifically concerned with dental disease, the principles of bacteriology are the same in all diseases.

In connection with a consideration of the effect of physical and chemical agents, there is a discussion of disinfectants and antiseptics, which is always of interest to the dental practitioner.

A study of this volume will broaden the vision of the dentist and give him a more comprehensive grasp of this important subject; all of which is needed among the rank and file of the profession.

A Textbook of Exodontia: Exodontia, Oral Surgery and Anesthesia. By Leo Winter, D.D.S., Professor of Oral Surgery and Director of the Oral and Minor Surgery Clinic, New York University College of Dentistry; Visiting Dental Surgeon in Charge, Bellevue Hospital; Lecturer in Oral Surgery, New York Homeopathic Medical School; Oral Surgeon, Flower Hospital; Lieutenant Commander, D.C.V. (S) U.S.N.R.; Special Lecturer and Instructor in Oral Surgery, Dental Department, U. S. Naval Medical School; Visiting Dental Surgeon, New York Foundling Hos-

pital. Second Edition. Profusely illustrated. 455 pages. Price, $10.00. Published by the C. V. Mosby Company, St Louis.

One of the outstanding features of this book is the profusion of illustrations, which is in keeping with the essentials in a work of this character. The only way that an adequate conception of operative procedure can be given a reader of such a volume is through the medium of pictures. To describe the technic of tooth extraction through the printed page alone is to fall far short of conveying a vivid idea of the various processes, and therefore the author has shown wisdom in making such a prominent feature of his illustrative work.

Much attention has naturally been given to the subject of anesthesia, general and local; as well as to the other topic, of a constantly increasing interest; viz., impacted teeth.

It seems only a brief period since the first edition of this book appeared, which is a circumstance that must be gratifying not only to the author but also to the publisher.

Nutrition and Physical Fitness. By L. Jean Bogert, Ph.D., Formerly Instructor in Medicine, University of Chicago, Instructor in Experimental Medicine, Yale University, Research Chemist, Obstetrical Department, Henry Ford Hospital, Professor of Food Economics and Nutrition at the Kansas State Agricultural College. 540 pages; 65 illustrations. Cloth, $3.00 net. Published by the W. B. Saunders Company, Philadelphia and London, 1931.

The keynote of this volume may be stated in a single sentence in the preface, as follows: "Perhaps the chief aim has been to show how nutritional knowledge and hygiene may be made to serve as tools for building positive health."

The author is evidently not an extremist, but she does not deal in half truths on any of the various topics. In common with the consensus of opinion among diet experts emphasis is given to the value of such foods as milk, fruits and vegetables, and food accessories. Then a somewhat comprehensive study is given to the "need of the body for energy and use of food as fuel," and an intelligent consideration is given to the question of vitamins and their functions.

A chapter is given to the consideration of building menus, regarding which will be found much valuable information of a practical nature.

The book as a whole is well worthy of a place in every medical and dental library, and the author deserves the commendation of everyone interested in the subject.

The Doctor and His Investments, Financial Policy and Technique for the Physician. By Merryle Stanley Rukeyser, B.Lit., M.A., Financial Editor, Medical Economics and Dental Survey; Financial and Editorial Writer, New York American and Associated Newspapers; Associate in Journalism, Columbia University. 330 pages. Price, $2.50. Published by P. Blakiston's Son & Co., Inc., Philadelphia.

If there is one thing that the professional man needs to know regarding his economic problems, it is in connection with the investment of his savings. It is one thing to earn money, and a wholly different thing to wisely invest it. More men have failed in connection with the latter than with the former, and it is here that the closest study should be given if the result is to be satisfactory. To insure a successful and happy old age, the professional man should be grounded in the essentials of sound financial principles, and everything bearing on investments is of the utmost moment to him.

This book was written by a man who has had a wide experience in financial and economic study and he brings to bear on the subject a broad basis for advice. The prime requisite of economic success is judicious saving. In one place, the author says: "The habitual saver joins forces with the magic of compound interest, which opens the certain road to fortune."

A very interesting and instructive chapter is the one on "A balanced investment diet." It would be well for the reader to study this chapter somewhat carefully. No one class of investments is suitable for all occasions, nor for all times. The wise investor will study periodic trends and be enabled to take advantage of the varying conditions.

This is a book that will be found very valuable, and it will well repay reading and studying.

Studies in the Masticatory Movements of the Human Lower Jaw. By G. Y. Hildebrand, Licensed Dental Surgeon, Laborator in Prosthetics and Orthodontia at the Dental Institute of the Royal Caroline Medico-Chirurgical Institute in Stockholm. 206 illustrations. Published by Walter De Gruyter & Co., Berlin and Leipzig, 1931.

This author goes quite fully into the subject, and advances some very interesting theories. The fact that 151 pages of text and

forty pages of cuts and graphs are embodied in the work will indicate something of the detail. As justification for this, the author says, in Chapter 5: "It is of great importance for the estimation of the value of the results to give a full description, not only of the method employed, but also of the material on which the method has been employed."

It is one of the most comprehensive studies of this subject that we have seen and it should claim the attention of everyone who is at all interested in it.

FIRST THINK CAREFULLY—THEN WRITE!

By Jan Fridrichovsky, Bratislava, Czechoslovakia

In the September, 1930, number of THE JOURNAL, page 1778, a short article by L. Helmer states that the geometrical delineations of most dentists are wrong. Among a large number of writers J. W. Needles has been fortunate to be exempt from this criticism. In Helmer's article, Gysi is specially attacked. Marked errors are supposed to have crept into the geometric drawings which he published in the August, 1930, number of THE JOURNAL in an article entitled "Development of the Articulator."

Helmer's article leads me to reply, since from his representations, it seems that most authors, especially Gysi, have no idea of elementary geometry. We are compelled to agree that publication of inaccurate drawings is to be condemned. But let us examine Figure 3 of Gysi's paper, to see to what extent Helmer is justified in his accusation. We see that it deals with the reproduction of a side-bite movement of the mandible. In the drawing, we find, among other things, the balancing condyle path and the gothic arches (central, left and right) represented schematically.

The movements of all these particular points of the mandible have different directions and magnitudes; which indicates that all these movements can be regarded as a rotation around a common center. This center Gysi determined by erecting perpendiculars on the condyle path and the gothic arch paths. Where these perpendiculars meet, the rotation axis passes through the plan, represented by Gysi's Figure 3. With the help of this center, the condyle path and the gothic arches can be described as being segments of circles.

Naturally, it is impossible to draw a line at right angles to a segment of a circle. A perpendicular on a segment can be properly made only, as Helmer rightly says, if a chord is first drawn to the segment and the chord bisected. Then only the perpendicular, drawn at the bisected point of the chord, will pass through the center of the circle of which the segment forms a part. Now, the perpendiculars of Gysi's Figure 3 are the radii of the circles to which the condyle path and the gothic arches belong. We will now study the relative magnitudes of the condyle path and gothic arches as compared with the circumference of the circles to which they belong. If the length of a radius is known, the circumference of the circle can be computed ($2 \times r \times 3.1416$).

In order to get natural relationships, we will enlarge Gysi's Figure 3 to about twice its size, corresponding to an intercondylar distance of 100 mm.

In our case, the radius of the left gothic arch has a length of 172 mm. We complete the circle with 172 mm. radius, and see that the movement, which forms the gothic arch in Figure 3 of Gysi's publication, is only a very small fraction of the relatively great circumference of the circle. The circumference of this circle is $2 \times 172 \times 3.1416 = 1{,}080$ mm. If now our left gothic arch has a length of about 8 mm., we see that a segment of 8 mm. in the circumference of a circle of 1,080 mm. can practically be considered as a "straight" line, because it forms only the one one hundred and thirty-fifth part of the whole circle. This same relation is also true for the other paths of Gysi's Figure 3. It is therefore irrelevant where the perpendicular is drawn on this "straight" line: whether in the middle or at one end or the other. In other words, the gothic arch and the condyle path is equal to one side of a polygon of 135 sides, which cannot be distinguished from small segments of the same length.

Let us now examine the drawings which Helmer gives in his publication in support of his assertion. His circles have a radius of 13 mm., the circumference of which would therefore measure $2 \times 13 \times 3.1416 = 81$ mm. We will, however, also enlarge Helmer's drawings to twice their size, to be able to compare his drawings with ours.

The radius of Helmer's circle enlarged to twice the size would then be 26 mm. and the

circumference 2×26×3.1416=163 mm. Helmer now draws a chord of 11 to 22 mm. This chord is equal to one side of a seven-sided polygon which could be drawn inside his circle. If he wants to establish the center of the circle, he must, as he properly did, bisect his illustrated straight chords and only then the perpendicular will go through the center of the circle. Of course, if he draws the perpendicular from one end of his relatively long chord, this perpendicular can never go through the center of the circle. So far, we have no objections to raise against Helmer's drawings, which are correct from a purely geometric point of view.

Let us now compare the circle one gets in Gysi's sketch with the circle which Helmer gives us.

Gysi's circle has a radius of 172 mm. Helmer's circle has a radius of only 26 mm. The first mentioned circle has a circumference of 1,080 mm., the second circle, however, only one of 163 mm. Gysi's "straight line" measures 8 mm.; Helmer's, on the contrary, 11 to 22 mm. This last mentioned straight line, as already mentioned, is the one-seventh part of the circumference of his circle. On the other hand, Gysi's "straight line" forms only the one one hundred and thirty-fifth part of the circumference of his circle.

Gysi draws his perpendiculars on a relatively small segment of his large circle, and if he would draw a chord to this small segment of the circle, this chord would practically cover the corresponding part of the circle. Therefore, Gysi is free to draw his perpendiculars either on the end or in the middle of the gothic arch and the condyle path. As a matter of fact, it is even better to draw the perpendiculars on the beginning of the gothic arch and the condyle path, because the lateral excursions of the mandible, which bring the molars in lateral occlusion on the balancing and working side, are so small that only a small part of the beginning of the gothic arch and the condyle path is used.

In his illustration, Helmer would have had to take a chord corresponding to the one one-hundred and thirty-fifth part of the circumference of his circle, and on this he should have drawn his perpendiculars. Of course, it would be very difficult to draw a perpendicular on such a small segment of a circle by using an ordinary right angle. But by the use of Bakker's "mirror ruler" as Gysi has described it in his latest publication (Scheff's handbook of dentistry, volume on prosthetics), it is easy to erect a right angle on very small segments of a circle.

We can assure Helmer that if he had done this way, his perpendicular would also have gone through the center of his circle. If Helmer had kept to the proportion of Gysi's drawings, which correspond to natural relations, he would not have made this mistake.

NEWS

DeLos L. Hill, Jr., Dental Clinic for Children: Announcement has just been made by Sheppard W. Foster, president of the Atlanta Southern Dental College, Atlanta, Ga., of the receipt of $50,000 from the estate of the late DeLos L. Hill, former member of the faculty of the college, which, in accordance with the terms of Dr. Hill's will, is to be applied toward the establishment of a dental clinic for children, the clinic to be a memorial to the late DeLos L. Hill, Jr., who died at the age of 11 years. Establishment of a children's clinic will increase the capacity and efficiency of one of the largest dental clinics in the United States. This clinic is situated on the top floor of the main building of the dental college and under the direction and supervision of a staff of graduate dental instructors. The clinic at present has 134 chairs and accommodates thousands of persons from Atlanta and environs who are in need of dental care.

Eastern Society of Dental Anesthesia Elects Officers: Following are the officers of the Eastern Society of Dental Anesthesia for the year 1931-1932: honorable president, Harry M. Seldin, New York City; president, Philo F. Hildebrand, New York City; vice-president, Charles Siegel, Middle Village, L. I.; treasurer, H. B. Rosenthal, Flushing, L. I.

Deaths

Pollard, C. E., Wenona, Ill.; Chicago College of Dental Surgery, 1910; died, August 6, in an automobile accident; aged 53.

Idomoto, Yasuno Suke, San Francisco, Calif.; College of Physicians and Surgeons, School of Dentistry, 1915; died, July 4.

Hursh, Ray L., San Francisco, Calif.; College of Physicians and Surgeons, School of Dentistry, 1902; died, June 25.

Gardiner, James Creighton, Evanston, Ill.; Northwestern University Dental School, 1896; died, August 29; aged 77. Dr. Gardiner retired in 1929.

Hoover, J. L., Shelbyville, Ill.; University of Michigan, School of Dentistry, 1894; died, September 26; aged 62.

Jaros, Joseph E., Riverside, Ill.; University of Illinois, College of Dentistry, 1917; was killed in an automobile accident, September 27; aged 38.

Frantz, L. O., Alliance, Ohio; died, July 11; aged 60.

Bliss, John A., Sioux City, Iowa; Drake University, College of Dentistry, 1912; died of heart disease, May 19; aged 56.

Renfrow, Ivan M., Denver, Colo.; University of Louisville, School of Dentistry, 1904; died, July 15.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Buffalo, N. Y., 1932.

Chicago Dental Society, January 18-21.

Dental Protective Association, Chicago, Ill., December 21.

Greater New York, New York City, November 30-December 4.

Kings County Dental Society of Brooklyn, N. Y., February 25-27.

Odontological Society of Western Pennsylvania, Pittsburgh, November 18-20.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

Southern Society of Orthodontists, Cincinnati, Ohio, December 1-3.

St. Louis (Mo.) Dental Society, December 7-9.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

November

Connecticut, at New Haven (4).

December

Ohio, at Cincinnati (1-3).

February

Minnesota (24-26).

April

Michigan, at Detroit (11-13).
New Jersey, at Atlantic Cty (13-15).

May

Maryland, at Baltimore (2-3).
New York, at Albany (11-13).

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 14. Bert Boyd, Secretary, 610 South Broadway, Los Angeles.

Colorado, at Denver, December 1. Zenas T. Roberts, Secretary, 810 Metropolitan Bldg., Denver.

Connecticut, at Hartford, November 16-19. Almond J. Cutting, Recorder, Southington.

Indiana, at Indianapolis, November 16-19. J. M. Hale, Secretary, Mt. Vernon.

Iowa, at Iowa City, December 14. H. F. Pool, Secretary, Mason City.

Massachusetts, at Boston, November 2-4. W. Henry Grant, Secretary.

Michigan, at Ann Arbor, November 16. J. W. Lyons, Secretary, Union & Peoples Nat. Bank Bldg., Jackson.

Minnesota, at Minneapolis, December 11-19. Walter H. Smith, Secretary, 2337 Central Ave., Minneapolis.

New Jersey, at Trenton, December 7-12. John C. Forsyth, Secretary, 148 W. State St., Trenton.

Pennsylvania, at Philadelphia and Pittsburgh, December 9-12. W. A. McCready, Secretary, 115 Highland Bldg., Pittsburgh.

Rhode Island, at Providence, December 1-3. Albert L. Midgley, Secretary, 1108 Union Trust Bldg., Providence.

Texas, at Houston, December 1-4. A. L. Nygard, Secretary, 1232 Medical Arts Bldg., Dallas.

Wisconsin, at Milwaukee, December 14-18. S. F. Donovan, Secretary, Tomah.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

KINGS COUNTY DENTAL SOCIETY OF BROOKLYN

The Kings County Dental Society of Brooklyn will celebrate its twentieth anniversary at the St. George Hotel, Brooklyn, February 25-27. A cordial invitation is extended to every ethical dentist to attend.

MATTHEW D. LEVIN, *Chairman,*
Publicity Committee,
201 Eastern Parkway,
Brooklyn, N. Y.

MICHIGAN STATE BOARD OF DENTISTRY

A meeting of the Michigan State Board of Dentistry for the purpose of examination for license to practice dentistry or dental hygiene in the state will be held at the Dental Building, Ann Arbor, beginning at 8 a. m., November 16. For information address

J. W. LYONS, *Secretary,*
Union & Peoples National Bank Bldg.,
Jackson.

DENTAL PROTECTIVE ASSOCIATION

The annual meeting of the Dental Protective Association of the United States will be held at the Palmer House, Chicago, December 21, at 4 p. m. The report of the officers will be given, a board of directors will be elected and other business will be transacted.

By Order of the Board of Directors,

J. G. REID, *President,*
4642 Lake Park Ave.,
Chicago, Ill.

OHIO STATE DENTAL SOCIETY AND SOUTHERN SOCIETY OF ORTHODONTISTS

A concession of one and one-half fares on the "Certificate Plan" will apply for members and dependent members of their families attending the meeting of the Ohio State Dental Society and the Southern Society of Orthodontists to be held at Hotel Netherland Plaza, Cincinnati, Ohio, December 1-3, and these arrangements will apply from the following territory: Central Passenger Association Territory "A"; Canadian Passenger Association, Eastern Line Territory "B"; Southeastern Passenger Association "C"; New England Passenger Association "D"; Southwestern Passenger Association "E"; Transcontinental Passenger Association "F"; Western Passenger Association and Trunk Line Association "G." For further particulars, apply to

EDWARD C. MILLS, *Secretary,*
Ohio State Dental Society,
255 E. Broad St.,
Columbus, Ohio.

IOWA BOARD OF DENTAL EXAMINERS

The next meeting of the Iowa Board of Dental Examiners will be held in Iowa City the week starting December 14. Anyone wishing to take this examination must have his application properly executed and filed with H. W. Grefe, director, State House, Des Moines, fifteen days prior to the first day of the examination.

H. F. POOL, *Secretary,*
Mason City.

EASTERN SOCIETY OF DENTAL ANESTHESIA

The next meeting of the Eastern Society of Dental Anesthesia will be held at the Barbizon Plaza, New York City, November 13, instead of November 20 as previously announced. A dinner (7 p. m.) will precede the lecture. Membership is open to all ethical practitioners subscribing to the code of ethics of the American Dental Association.

JOHN B. WOODMAN, *Secretary,*
57 W. 57th St.,
New York City.

CONNECTICUT STATE DENTAL ASSOCIATION

The 1931 midwinter meeting of the Connecticut Dental Society will be held at the rooms of the New Haven Medical Association, New Haven, November 4.

C. W. VIVIAN, *Secretary,*
New Britain.

SOUTHERN SOCIETY OF ORTHODONTISTS

The twelfth annual meeting of the Southern Society of Orthodontists will be held at the Netherland Plaza Hotel, Cincinnati, Ohio, December 1-3. The meeting will be held in conjunction with the Ohio State Dental Society. All members of the American Dental Association and members of the various orthodontic societies are cordially invited.

OREN A. OLIVER, *Secretary.*

GREATER NEW YORK DECEMBER MEETING FOR BETTER DENTISTRY

The seventh Greater New York December Meeting for Better Dentistry will be held at the Hotel Pennsylvania, New York City, November 30-December 4. The sessions will open at 2 p. m., November 30, with a joint meeting of physicians and dentists, which will continue through Monday afternoon and evening. Admission to the regular sessions, which begin Tuesday, will be by card only. At 9 o'clock each morning, a practical talk will be given, followed by lecture demonstrations, which will occupy the time from 10 to 12. It will be necessary to make application for cards for these demonstrations. On Monday evening, a dinner will be given, which will be attended by both physicians and dentists assembled for the joint meeting. On Wednesday noon a luncheon which has been dedicated to children's dentistry will be held in conjunction with the New York Tuberculosis and Health Association. All members of the American Dental Association are invited to attend this meeting and programs will be mailed to members in New York, New Jersey and Connecticut. Members from other states can secure programs by addressing Miss Edith M. Davis, Executive Secretary, 2 East 103rd Street, New York.

JOHN T. HANKS, *Chairman.*

NEW JERSEY STATE DENTAL SOCIETY

The sixty-second annual meeting of the New Jersey State Dental Society will be held in the Hotel Chelsea, Atlantic City, April 13-15. For information on exhibits address Earl L. D. Hester, 34 East Palisade Ave., Englewood; on clinics, E. J. H. Schneider, 806 Clinton Ave., Newark; on general items, address

F. K. HEAZELTON, *Secretary,*
223 East Hanover St.,
Trenton.

TEXAS STATE BOARD OF DENTAL EXAMINERS

The Texas State Board of Dental Examiners will hold their fall examination in Houston, December 1-4.

A. L. NYGARD, *Secretary,*
1232 Medical Arts Bldg.,
Dallas.

CHICAGO DENTAL SOCIETY MIDWINTER MEETING

The Chicago Dental Society extends a cordial invitation to all members of the American Dental Association and to members of recognized foreign dental associations to attend its sixty-eighth annual midwinter meeting at the Stevens Hotel, January 18-21. Address all communications and application for space to the office of the Exhibit Committee, Chicago Dental Society, 185 N. Wabash Ave.

HOWARD C. MILLER, *Secretary,*
55 E. Washington St.,
Chicago.

MINNESOTA BOARD OF DENTAL EXAMINERS

The next meeting of the Minnesota State Board of Dental Examiners will be held at the University of Minnesota, Minneapolis, December 11-19. For application and further information, address

WALTER H. SMITH, *Secretary,*
2337 Central Ave.,
Minneapolis.

IOWA COLLEGE OF DENTISTRY AND ALUMNI CLINIC

The twenty-third annual meeting of the College of Dentistry and Alumni Clinic will be held November 20-21, at Iowa City. All ethical members of the profession are invited.

L. M. FITZGERALD, *Secretary,*
Alumni Association.

MASSACHUSETTS BOARD OF DENTAL EXMINERS

The Massachusetts Board of Dental Examiners will hold an examination for registration of dentists and oral hygienists in the City of Boston, November 2-4. Full information, application blanks, etc., may be secured at the office of the secretary, Room 141, State House, Boston. All applications must be filed at the office of the secretary at least ten days before the date set for the examination.

W. HENRY GRANT, *Secretary,*
146 State House,
Boston.

PENNSYLVANIA STATE BOARD OF DENTAL EXAMINERS

The Pennsylvania State Board of Dental Examiners will hold its next examinations December 9-12 at Philadelphia and Pittsburgh. Candidates should apply to the Department of

Public Instruction, Harrisburg, for the necessary blanks and on return of same with fee and photographs at least ten days before the date of examination, instructions, order and information regarding place of examinations will be sent to applicant.

W. A. McCready, *Secretary*,
1115 Highland Bldg.,
Pittsburgh.

MARYLAND STATE DENTAL ASSOCIATION

The Maryland State Dental Association will hold its annual meeting at the Southern Hotel, Baltimore, May 2-3.

Walter L. Oggesen, *Secretary*,
Baltimore.

ST. LOUIS DENTAL SOCIETY

Seventy-Five Years of Dentistry

What is the background of your profession? How does the practice of dentistry differ from what it was twenty years ago? Thirty-five years ago? Fifty years ago? Seventy-five years ago?

St. Louis is not leaving a stone unturned in preparing for and sponsoring a unique meeting commemorating the seventy-fifth anniversary of the founding of the St. Louis Dental Society. Not only will there be illustrated the history of each branch of dentistry and other historical features, but there will also be a scientific program of merit and featuring some of the best in dental thought at the present time.

Railroads will cooperate with the usual one and one-half round trip rate to and from St. Louis. Air lines will allow a 10 per cent reduction. Be sure to ask for certificates when buying tickets.

Publicity Committee.

THE CHRISTMAS SEALS

We are approaching the Christmas season, at which time we are supposed to open our hearts and extend good cheer to all who need it. One of the simplest methods of doing good along these lines is to purchase Christmas Seals. You will shortly receive a package containing 100 seals for which you are asked to pay the small sum of $1.00.

It is an astonishing fact that for the past ten years only about two-fifths of the members have responded to this appeal. It is astonishing because dentists as a rule are neither stingy nor selfish. Probably the truth is that procrastination is the explanation, so this year please send $1.00 (or $5.00 or $10.00) just as soon as you receive the seals.

I feel that it is proper for me to inform the membership of the following fact. While so many men are neglecting this obligation to their needy colleagues, in all honor to one man, let me report that James F. Moon, of East Orange, N. J., has been sending me a check for $3.00 every month for the past year and a half. This makes Dr. Moon the largest individual contributor to the Fund, and I feel that at least this public recognition is due him and I trust that Dr. Moon's attitude may inspire others to support the Fund this season.

R. Ottolengui, *Chairman*.
Dental Relief Fund Committee,
American Dental Association.

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Vol. 1